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ODDA AND RJUKAN:
TWO INDUSTRIALIZED AREAS OF NORWAY*

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"ESSENTIAL to a distinction of urban from rural is our conception of population. . . . What is rather carelessly called rural population is only the least nucleated part of a highly nucleated whole. . . . We often see comparisons of the percentages of urban or rural inhabitants in different countries. It is the writer's impression that these percentages are not comparable, being based on a great variety of definitions of a city."[1] These excerpts from Mark Jefferson's "Distribution of the World's City Folks" are rather closely paralleled by the following statement on rural and urban population in the 1948 United Nations' Demographic Yearbook. "The designation of areas as urban or rural is so closely bound up with historical, political, cultural, and administrative considerations that the process of developing uniform definitions and procedures moves very slowly."

The population of Norway is considered as being 72 per cent rural and 28 per cent urban. These figures are based upon the legally designated and demarcated urban units. In the 1946 Norwegian census there are listed some 2,272,853 rural inhabitants of whom 959,358, or approximately 42 per cent, are engaged in such activities as industry and hand work, commerce, and transportation; and of these, 636,280, approximately 28 per cent of the total, are engaged in industry and hand work (Table II). According to a business census of 1936 there were in Norway 31,342 concerns, employing 307,252 people, engaged in industrial, mining, and construction activities; 18,265 or 58 per cent of these were listed as located in rural districts and these employed 154,733 individuals, approximately 50 per cent

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[1] M. Jefferson, "Distribution of the World's City Folks," *Geographical Review*, XXI (1931): 446.

TABLE I

Industrial Places With Over 1,000 Inhabitants

	Name[2]	Site[1, 4, 5]	Elevation in meters[5]	Population[2]	Installed Water Power in kW., 1943[3]				
					Elec. kW.	Other kW.	General	El. Chem. El. Therm.	Lumbering
1	Torp	T	30	1948	..	..	..	..	..
2	Askim	R	130	3744	..	..	..	..	..
3	Mysen	R	107	2460	257	0	257	0	0
4	Greåker	RT	0	2006	..	..	..	..	..
5	Brumunddal	RL	124	2729	495	107	527	0	75
6	Raufoss	RP	350	2403	442	0	442	0	0
7	Jevnaker	R	420	2114	3670	1691	1999	0	3362
8	Geithus	RPT	55	1537	405	2210	0	0	2615
9	Åmot	RPT	35	1128	9097	3600	0	0	12697
10	Mjøndalen	RPT	1	2904	72	75	0	0	147
11	Krokstadelva	PT	1	1579	405	0	0	0	405
12	Slemmestad	R	..	1346	..	..	..	..	..
13	Tofte	PF	1	1451	367	0	0	0	367
14	Skotfoss	P	..	1882	3280	7030	0	0	10310
15	Ulefoss	P	..	1448	2098	1632	898	0	2832
16	Rjukan	P	260	5460	282500	0	0	282500	0
17	Eydehamm	C	1	1191	..	..	..	..	..
18	Bryne	R	..	2124	184	0	184	0	0
19	Ålgård	..	..	1271	..	..	..	..	..
20	Jørpeland	C	3	1837	6845	0	550	6295	0
21	Sauda	FP	1	3299	92370	0	6000	86370	0
22	Odda	FP	1	6202	125660	0	5000	120660	0
23	Tyssedal								
24	Ytre Arna	..	..	1678	..	..	..	..	..
25	Dale	RP	30	1823	59542	0	59542	0	0
26	Høyanger	PF	..	2690	39260	0	1210	38050	0
27	Maløy	C	1	1805	223	0	223	0	0
28	Ulsteinvik	C	1	1306	..	..	..	..	..
29	Volda	C	1	2341	124	0	124	0	0
30	Langevåg	C	1	2606	582	0	582	0	0
31	Løkkens Verk	..	..	2501	..	..	..	..	..
32	Rørosbergstad	RX	628	2556	18	140	158	0	0
33	Ranheim	PRF	1	2138	1105	245	100	0	1250
34	Hommelvik	RF	1	2106	3	0	3	0	0
35	Verdalsøra	RF	1	2084	70	0	50	0	20
36	Sulitjelma	XP	..	2155	8395	0	4895	3500	0
37	Kirkenes	C	1	2100	..	..	..	..	..
Total				82012	637469	16730	82744	537375	34080
Country Total					2216645	84533	1208361	824001	268818

[1] Norges Statsbaner, *Fortegnelse Over Ekspedisjonsteder Og Sidespor.* (Oslo: Grondahl & Sons Boktrykeri, 1947).

[2] Statistisk Sentralbyra, *Folketellingen i Norge, Forste Hefte.* (Oslo: H. Aschehoug & Co., 1950). Tabell p, p. 20*.

[3] Norges Vassdrags og Elektrisitetsvesen, *Utbygd Vannkraft i Norge.* (Oslo: H. Aschehoug & Co., 1946). Tabell III, p. 22.

[4] C—Coastal position either on mainland or some island. F—A fjord site. L—Lake. P—There is a water power development in the area. R—Official station on the Norwegian State Railway. T—River site (Timber flotation). X—Some mineral resource nearby.

[5] Official Norwegian Topographic Sheets.

of the national total.[2] The latest census figures for Norway show a total of 454,791 individuals over fifteen years of age engaged in industry and handcraft; of these 276,473 are classified as rural (Table II).

TABLE II

Population According to Occupation*

District	Total	Agriculture & Forestry	Fishing & Whaling	Industry & Handwork	Commercial	Transportation	Remainder
Nation	3156950	783963	183922	992477	313389	287821	595378
Rural	2272853	774114	177254	636280	146251	176827	362127
Urban	884097	9849	6668	356197	167138	110994	233251

Population Over 15 Years According to Occupation*

District	Total	Agric. & Forest	Fishing & Whaling	Industry & Handwork		Commercial			Transportation		Remainder
				Handwork	Industry	Wholesale, Retail	Banking, Insurance	Hotel Restaurants	Shipping	Other	
Nation	2441884	333748	70587	101159	353632	122754	20099	22456	48782	81981	1286686
Rural	1715714	329110	67874	61151	215322	55535	7300	8712	28770	48410	893530
Urban	726170	4638	2713	40008	138310	67219	12799	13744	20012	33571	393156

* Statistisk Sentralbyra, *Folketellingen I Norge, Tredje Hefte.* (Oslo: H. Aschehoug & Co., 1951). Tabell 3, pp. 146–149 & 154–161.

These figures suggest three possible explanations for the distribution of this segment of the population. First, that there is a considerable amount of industrialization within the urban fringes of the major cities; second, that throughout the countryside there occurs a scattering of plants in a broadly dispersed pattern; third, that there exist a number of industrialized areas not possessing a legal city status. The purpose here is to examine this third possibility and to select two such areas, those of Odda and Rjukan, for closer scrutiny.

Before undertaking this however, it might be well to view at least briefly the two former possibilities. In many Norwegian cities the urban development has extended beyond administrative boundaries and the population has increased considerably more in the suburbs than it has in the city proper. Although the aforementioned business census was based on 1936 figures, the general over-all picture has probably not changed greatly except for the expansion of Oslo's city boundary to include all of Aker parish. This expansion absorbed some 506 industrial estab-

[2] Det Statistiske Sentralbyra, *Bedriftstelling I Norge, Annet Hefte.* (Oslo: H. Aschehoug & Co., 1939). Tabell 1, p. 2.

TABLE III

Cities and Industristeder by Population Size

Size Group	No. of Cities*	No. of Industristeder*
Less than 1,000	5	0
1,000– 2,000	10	16
2,000– 3,000	11	17
3,000– 4,000	8	2
4,000– 5,000	4	1
5,000– 6,000	1	1
6,000– 7,000	4	0
7,000– 8,000	1	0
8,000– 9,000	0	0
9,000– 10,000	3	0
10,000– 15,000	9	0
15,000– 20,000	4	0
20,000– 25,000	1	0
25,000– 30,000	1	0
30,000– 35,000	0	0
35,000– 40,000	0	0
40,000– 45,000	0	0
45,000– 50,000	0	0
50,000– 60,000	2	0
60,000– 70,000	0	0
70,000– 80,000	0	0
80,000– 90,000	0	0
90,000–100,000	0	0
More than 100,000	2	0
Total	66	37

* Statistisk Sentralbyra, *Folketellingen i Norge, Forste Hefte.* (Oslo: H. Aschehoug & Co., 1950). Tabell 2, pp. 19–21; Tabell p, p. 20*.

lishments employing 11,771 individuals. An important part of this same census publication is its Table III in which have been set up seven districts each including a major Norwegian city or cities and their environs. Some 2,483 concerns, employing 38,289 individuals, were located within the environs of the various cities listed.[3] It must be kept in mind that not all cities were considered and that the designation "environs" was on the basis of parish boundaries. It seems from these facts that some industrial activity does exist in the urban fringe, its extent possibly varying with the city and with the definition of environs.

Secondly, is there any basis for the contention that there exists a scattering of industrial sites throughout the countryside? This idea is somewhat more difficult to present through statistics. Possibly a few examples will suffice to give some notion of the extent of scattering. Geilo is a small, well known mountain resort located on the Bergen-Oslo railroad about 239 kilometers from Bergen (Fig. 1).

[3] Det Statistiske Sentralbyra, *Bedriftstelling I Norge, Annet Hefte.* (Oslo: H. Aschehoug & Co., 1939). Tabell 3, p. 134.

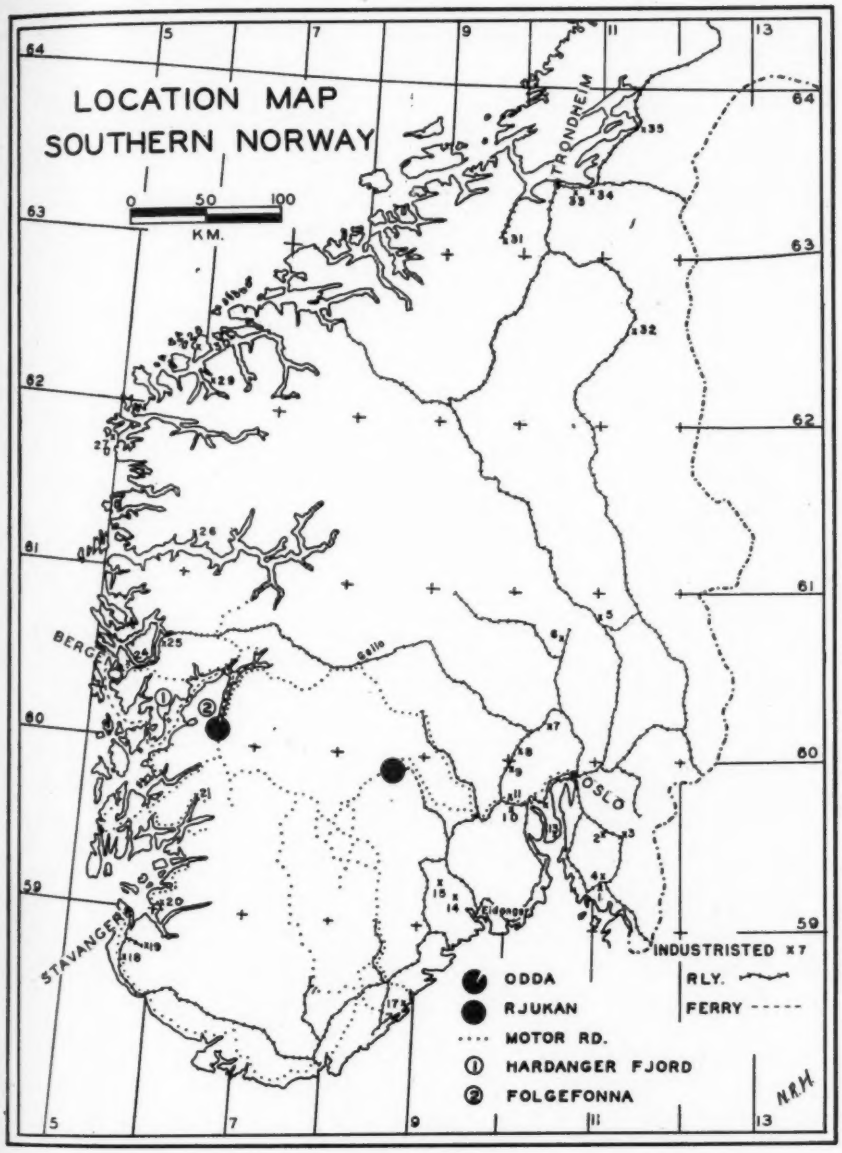

LOCATION MAP
SOUTHERN NORWAY
0 50 100
KM.
TRONDHEIM
BERGEN
OSLO
STAVANGER
INDUSTRISTED x 7
ODDA
RJUKAN
MOTOR RD.
HARDANGER FJORD
FOLGEFONNA
RLY.
FERRY
NRH

FIG. 1.

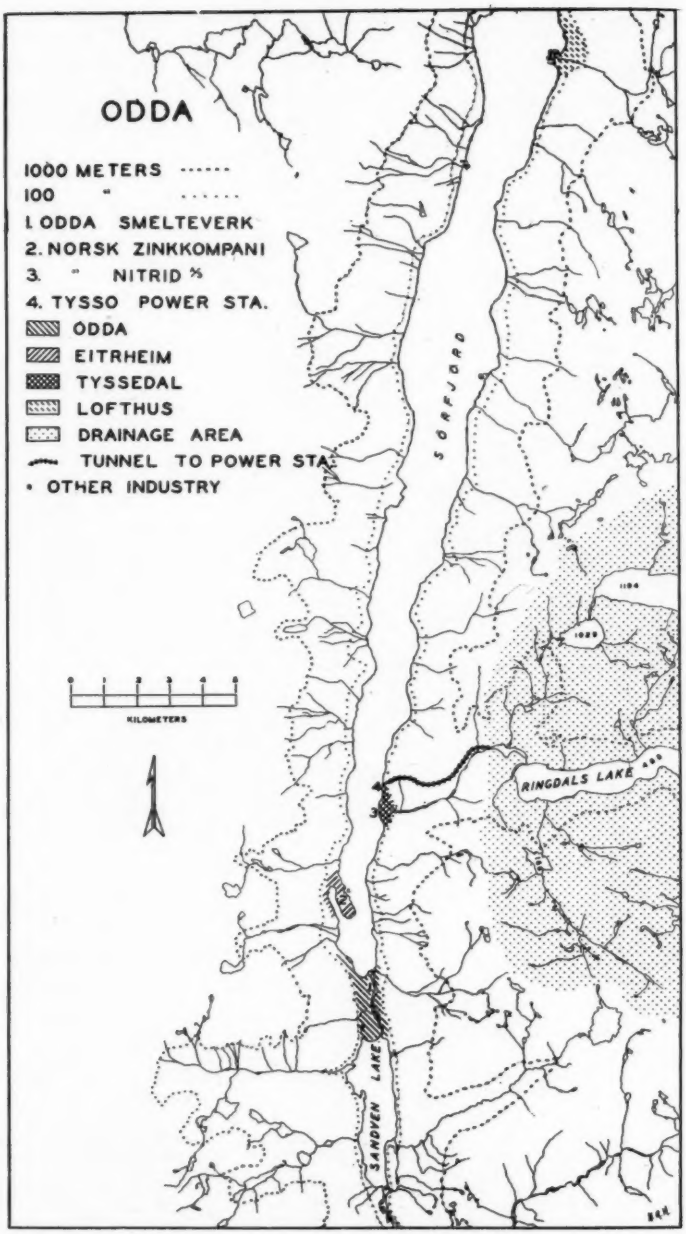

ODDA
1000 METERS
100 "
1. ODDA SMELTEVERK
2. NORSK ZINKKOMPANI
3. " NITRID ⅛
4. TYSSO POWER STA.
ODDA
EITRHEIM
TYSSEDAL
LOFTHUS
DRAINAGE AREA
TUNNEL TO POWER STA.
• OTHER INDUSTRY
KILOMETERS
SORFJORD
RINGDALS LAKE
SANDVEN LAKE

FIG. 2.

Although set among the wild, rugged grandeur of the Norwegian highlands, and known primarily for its excellent skiing terrain and other resort attractions, this small area is also a knife manufacturing center. There are three firms engaged in the manufacture of stainless carving and bread knives, scythes, axes, potato hooks, hoes, and numerous related articles. Production is primarily for domestic consumption, with some export to Denmark, the United States, Latin America, Holland, the Faroes, and Switzerland.[4] Another example is the Glomfjord Nitrate Factories, located at the head of the Glomfjord, 20 kilometers north of the Arctic Circle and 50 kilometers south of the town of Bodø. Here both the hydroelectric power facilities and the ice-free fjord route are utilized in the manufacture of liquid ammonia. The product is shipped by tankers to the nitrate factories at Herøya in southern Norway, a distance of 828 nautical miles. Along the Sörfjord, north

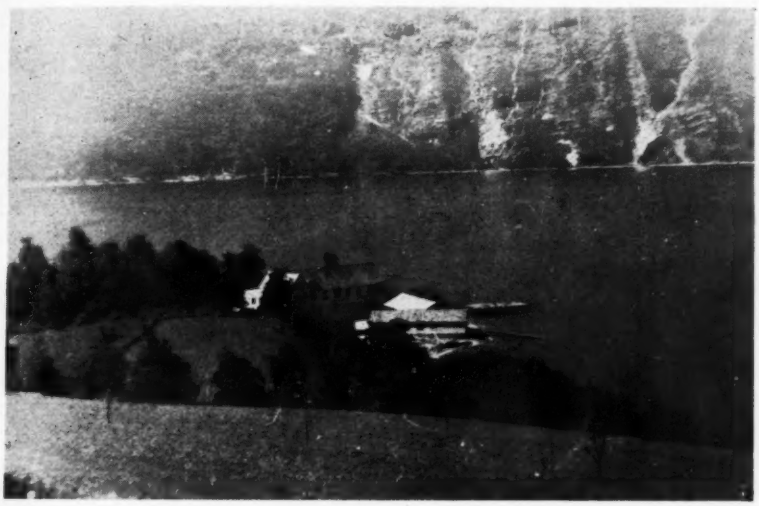


FIG. 3. Hardanger Furniture Factory in Lofthus. In the background is the Sörfjord. Notice the small quay. The small elongated building in the front and to the right is a saw mill.

of Odda, are located several establishments likewise engaged in industrial activities. In Lofthus (Fig. 2) which is on the east side of the fjord near its northern extremity, there is a furniture factory, the Hardanger Møbel Fabrikk (Fig. 3). This plant, located on the shore of the fjord, employs from twenty-five to thirty people. All of its materials are shipped in by boat and the finished products too are shipped out by water. All types of furniture are made,—bedroom suites, kitchen cupboards, dining room suites, divans. Such local woods as fir and birch are widely utilized, but the finer woods, mahogany, oak and walnut, imported by way of Bergen, are also used. Also in Lofthus is a shop manufacturing clogs, that is,

[4] "Knife Manufacturing Centre in Norwegian Mountain District," *Norwegian Export Council Reports*, #40 (Sept. 24, 1949).

wooden soled shoes with leather uppers, which are in great demand as foot wear for the fishermen and for the workers in the chemical plants in Odda. This manufacturing activity, carried on by a father and son, is economic geography in miniature. The shop has English and American sewing machines, cutting tools made of Swedish steel, a press from Germany. The raw materials include wood for the soles from Norway, Argentine cowhides tanned in Bergen, Norwegian cowhides tanned in the shop, and linen thread from Belfast. The soles are shipped in from another small home industry shop near Stavanger. Across the Sörfjord on the west side is the tiny development of Åga near which is located a canning factory which produces preserves, jellies, and jams, utilizing to a large extent the fruit grown in the region. These are only a few examples; many others exist throughout the country.

"INDUSTRISTEDER"

What of the third possibility? Do there exist a number of industrialized areas not possessing a legal city status? "Besides the suburbs, other densely built up areas in the rural districts have also had a strong population increase. Many of these built up areas (hussamlinger[5]) have a purely urban character. . . . A large part of the population in the rural districts are dwelling in closely built up areas of a more or less urban character."[6] Table IV indicates the size of the population

TABLE IV

Population in the Different Types of Built Up Areas (Hussamlinger)[1]

Type	No. of Built Up Areas	Population	Average Population per Built Up Area
Suburbs	244*	351,549	1441
Industrial places (Industristeder) not suburbs	179	133,761	747
The larger institutions	26	5,511	212
Other built up areas in the interior	217	78,793	363
Other built up areas on the coast	397	129,394	326
Total	1063	699,008	658
Total without surburbs	819	347,459	424

* Several of these are in reality connected.

[1] Statistisk Sentralbyra, *Folktellingen i Norge, Forste Hefte.* (Oslo: H. Aschehoug & Co., 1950). Tabell m, p. 16*.

[5] In the census all these various types of built up areas are grouped under a common term—*hussamlinger.* It includes city suburbs, industrial places, station towns, coastal places, fishing villages, etc.

[6] Statistisk Sentralbyra, *Folketellingen I Norge,* Forste Hefte. (Oslo: H. Aschehoug & Co., 1950). p. 15*.

located in these built up areas and its distribution among the various types of areas. The total population is large (approximately 79 per cent of the total in the cities) although the average per unit is quite small.

In a further refinement of these hussamlinger, the Norwegian census of 1946 has listed some thirty-seven "industristeder" ranging in size from 1128 to 5460 individuals (Table I). This particular category refers to settlements which meet the following requirements: (1) possess a population of at least 1,000, (2) have a more or less industrial base, and (3) are not an integral part of some city's fringe area. Their location in Norway is shown on the general location map of Southern Norway (Fig. 1). It is of interest to note that all but two (Sulitjelma and Kirkenes) fall within the confines of southern Norway. Another striking locational factor is the strong peripheral tendency closely parallelling that of most Norwegian cities. They also tend to cluster near the recognized urban centers of Norway.

Table III lists the Norwegian cities according to size. Fifty-seven per cent of all cities fall within the 1,000–5,000 size group and all but one of the industristeder fall within this range. Also of interest is the fact that the two largest groups of cities are the 1,000–2,000 and 2,000–3,000 size units, and so too are the industristeder concentrated within these two groups. The sizes of these industrial units are not insignificant when compared to Norwegian cities and on the basis of size alone they deserve to be considered in any observations concerning the over-all urban aspects of Norway. It must be remembered that Norway has only two cities of over 100,000 population. So long as the Norwegian urban units are considered on the national rather than the international level the size concept must be considerably reduced.

Table I lists all of the industristeder with some of the factors of their general characteristics. Fourteen of them are designated as official railroad stations, while

TABLE V

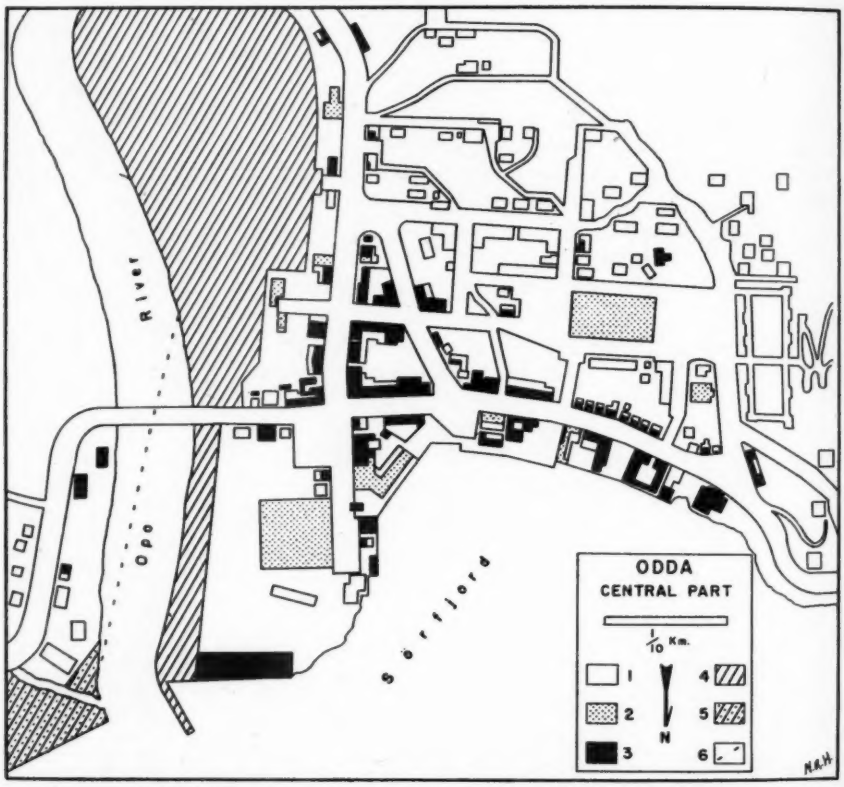
Installed Water Power in Norway by Size Groups—1943[1]

Size Group kW.	Number of Installations	
	Nation	Industrial Places
+50,000	10	4
20,000–50,000	16	3
10,000–20,000	19	4
5,000–10,000	30	4
2,000– 5,000	38	2
1,000– 2,000	78	5
500– 1,000	85	3
Less than 500	1733	30

[1] Norges Vassdrags og Elektrisitetsvesen, Utbygd Vannkraft I Norge. (Oslo: H. Aschehoug & Co., 1946). Tabell II, p. 11; Tabell III, p. 22.

eight have sites adjacent to some fjord. Twenty-four sites have some water power development. About 27 per cent of the total developed water power in Norway occurs in these industristeder and 40 per cent of those installations over 50,000 kW. are found in this settlement type (Table V). Of even more significance is the use to which this power is put. These settlements use better than 60 per cent of the water power consumed in the electro-chemical and electro-thermal industries (Table I). This 60 per cent is distributed among five industrial places: Rjukan, Sauda, Odda, Høyanger, and Sulitjelma.

Of the thirty-seven industristeder listed, two, Odda and Rjukan, have been chosen here for a more detailed examination. In the following survey these two places will be discussed and compared on the basis of three factors: (a) location and site, (b) size, and (c) function.



Source: Modified from a map in: *Odda,* Foreningen Norden, Odda Avdeling (Bergen: Boktrykkeri L/L, 1949). p. 16.

FIG. 4. 1) residential; 2) public; 3) commercial; 4) industrial; 5) Odda Smelteverk docks; 6) overhead, electrically operated buckets for unloading limestone.

ODDA

Odda, for statistical purposes, is located in Vestland in the parish of Odda and the county of Hordaland. Geographically it is at the head of the Sörfjord, a southward extending arm of the upper reaches of the Hardanger fjord (Figs. 1, 2, and 4). Although in an out-of-the-way place, it can be reached by bus, car, fjord steamer, or by a combination of train, ferry, and bus. The site of Odda is actually a sea-level, ice free port set at the bottom of a very deep ice-scoured valley. The hemmed-in nature of the site cannot be over emphasized. To the north stretches the long (42 kilometers), but very narrow Sörfjord; to the south, Sandven Lake; the Folgefonne peninsula with its ice-field roof creates the western limits; and the Hardangervidda, the eastern. Man's every move must take into account these thousand-meter-high walls of solid rock restricting the sea into this threadlike avenue of access.

Figure 2 shows that there are three centers of activity clustered around the southern end of the Sörfjord: Odda, Tyssedal, and Eitrheim. On the basis of proximity and function the three are considered here as a unit. Actually, according to the official statistics, Odda and Tyssedal are two separate industristeder and Eitrheim is a local name given to a very small nucleus of settlement. The term Odda also applies to the herred (parish) in which these centers are located. A glance at the population figures will show the concentration within these small centers.

Population 1946[7]

		Total
Odda	4800	
Tyssedal	1402	6202
Odda (parish)		8267

Non-Industrial Functions

From a functional standpoint the services performed here fall into three categories—political, commercial, and industrial. Odda as the center is similar to one of our county seats. Both Odda and Tyssedal have their own administration for fire and water. There is in Odda our equivalent of a city planner's office and the building laws for the whole parish are applied from here. Other municipal services centered here are a library, a cinema, the sheriff, the Hardanger police office, the hospital, and the district doctor's office.

The wholesale activities are on a small scale and constitute a rather small percentage of the total economic activity. These centers do not act as distributing points for the rest of the fjord area. Odda's main connection with the outside is by fjord steamer, particularly so where the shipments involved are large or bulky. Odda's position at the extremity of the fjord (Fig. 1) puts it at a disadvantage as a wholesale center in that the ships, as they come in from Bergen, have already stopped along the fjord to deposit and load their varied items of cargo.

[7] Statistisk Sentralbyra, *Folketellingen I Norge*, Forste Hefte. (Oslo: H. Aschehoug & Co., 1950). pp. 20*, 11.

The retail activities are likewise limited, although these differ from those of a larger city in degree rather than kind. There are the apothecaries, butcher shops, bakeries, a camera shop, grocery stores, small clothing shops, furniture stores, and book shops (Fig. 5). There are several restaurants, one or two hotels, and a meticulously clean dairy. There must necessarily be a sustaining force beneath any urban agglomeration and one need not go far to discover what it is in this

FIG. 5. Part of the central business district, Odda. Notice the combination commercial-residential structures, and the valley walls in the background.

community. The industrial character stands out clearly, from the pall of smoke that hovers over Odda to the penstocks which plunge along the sheer face of the fjord wall to the turbines below at Tyssedal.

Hydroelectric Power

Two factors form the frame upon which is spun the industrial fabric of this fjord community. If it did not possess the ice-free, sea-level route and the cheap hydroelectric power, Odda would not have developed beyond the resort stage. The alliance of natural resources has greatly aided the creation of the four industrial cogs in the area: A/S Tyssefaldene (hydroelectric power); Det Norske Nitrid-aktieselskap (aluminum production); Det Norsk Zinkkompani (zinc production); and the Odda Smelteverk A/S (calcium carbide and cyanimide).

Here on the western side of the Hardangervidda the Tysso River plunges from the high ice scoured mountains into the Sörfjord below (Fig. 2). The catchment basin is not large (approximately 339 square kilometers), but there is adequate precipitation to create a large flow of water in the many small rivers and streams along with a sufficient drop in elevation. There are many glacial lakes at various

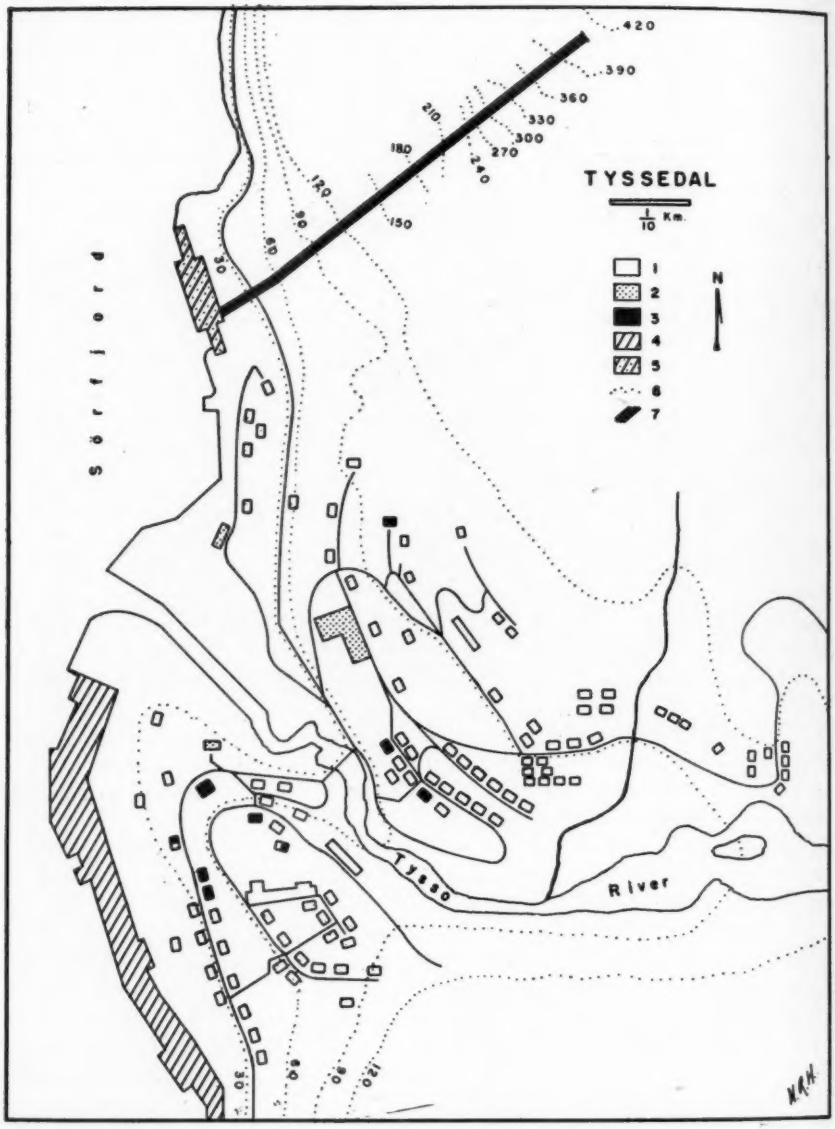
elevations and these lend themselves for use as regulating basins. The Tysso Power Company (A/S Tyssefaldene) was created in 1906. With the glacial lake Ringdalsvatnet chosen as a natural regulating basin, a dam was constructed across its outlet, thus forming a reservoir with a 445 million cubic meter capacity. Within this basin the flood waters from the melting snows are stored to be used in the following winter when the water level is low. Two tunnels shoot the water through the mountain to a distribution basin just above the power station at Tyssedal. From here the water is dropped by means of five penstocks to the turbines on the Sörfjord, 413 meters below. Here is generated approximately 105,000 hp. of which about 2,000 hp. goes to Tyssedal, 8,000 hp. to Odda municipal light company, 20,000 hp. to Odda Smelteverk A/S, 30,000 hp. to Det Norsk Zinkkompani A/S, and 45,000 hp. to Det Norsk Nitrid A/S.

Industrial Products

Aluminum production is carried on by Det Norsk Nitrid A/S, located in Tyssedal and employing approximately 500 men. As may be noticed on Figure 6, this plant is located directly on the fjord shore with direct access to ocean shipping. Production in 1949 was about 11,000 tons; modernization and expansion now underway will increase production (all of which is from imported aluminum oxide) to 15,000 tons per year.

Det Norsk Zinkkompani A/S, employing about 900 individuals, is located at Eitrheim. This particular concern is now producing about 45,000 tons of electrolytic zinc, 1200 tons of zinc alloys, 180 tons of cadmium, 80,000 tons of superphosphate, and some sulphuric acid. Its raw materials comprise 100,000 tons of zinc ore from Newfoundland, Australia, South America, Spain, Sweden, and Norway itself, and approximately 50,000 tons of raw phosphate.

The Odda Smelteverk A/S was started in 1908 in conjunction with the hydroelectric power development at Tyssedal. Its activities are centered around the production of calcium carbide and cyanimide. The plant is located on the west bank of the Opo River near the central part of Odda (Fig. 4). The raw materials, limestone and coal, are shipped in by boat and unloaded at the docking facilities located on the eastern side of the mouth of the river (Fig. 7). The port is excellent and vessels up to 12,000 tons can come directly alongside the docks. From here the limestone and coal are fed into the factory as needed, by electrically operated buckets suspended from an overhead track. The process begins with the burning of the limestone in huge limestone ovens. The burned limestone is then placed in an electric smelter with soderberg electrodes where it is smelted to calcium carbide at about 2200° C. The molten mass is then tapped from the smelter and allowed to cool in huge blocks. Of the normal yearly production of about 50,000 tons of carbide, 10,000 tons are packed as carbide and some 40,000 tons are further processed into cyanimide. The 10,000 tons of carbide destined for direct shipment are crushed, sorted, and packed into air tight steel drums which are themselves completely manufactured at the plant in Odda. Some of the main uses for this carbide are oxyacetylene welding and cutting, illumination, and production of



Source: Modified from a map in: *Odda,* Foreningen Norden, Odda Avdeling (Bergen: Boktrykkeri L/L, 1949). p. 16.

FIG. 6. 1) residential; 2) public; 3) commercial; 4) industrial; 5) hydro-electric power plant; 6) contours; 7) penstocks.

synthetic compounds. The carbide for further processing is finely ground and placed in electric cyanimide ovens. Nitrogen produced by the "Linde Process" is then passed through the ovens which are heated to about 1,000° C.; the resulting product is calcium-cyanimide with a 23 per cent nitrogen content. The raw cyanimide is further processed, its nitrogen content reduced to approximately 20.5 per cent and is then sold under several brand names.

In the production of one ton of carbide there are consumed approximately 1700 kilograms of limestone, 700 kilograms of anthracite coal, 200 kilograms of gas coal, and about 20 kilograms of electrodes. The electricity consumption is high

FIG. 7. Unloading limestone, Odda Smelteverk docks.

with a yearly rate of about 20,000 hp. One ton of raw cyanimide with a nitrogen content of about 23 per cent requires approximately 750 kilograms of carbide. The coal used is imported from Germany and England while the limestone is taken from the company's own quarries in Vestland. The yearly production is about 60,000 tons of cyanimide having a nitrogen content of about 20.5 per cent. Of this total approximately 5,000 tons is used in Norwegian agriculture and the remainder is exported. This industrial activity not only gives employment to some 600 individuals, but also creates a much needed source of foreign exchange.

RJUKAN

The second industristed to be examined is located in southern Norway approximately 120 kilometers west of Oslo in the county of Telemark and the parish of Tinn (Fig. 1). Although its general physical surroundings are also those of a heavily glaciated region, the specific site conditions are altogether different from those in Odda. Here there is no ice-free sea level route to the coast. All human

FIG. 8. Vestfjord Valley looking toward Rjukan from just east of Vemork. Notice the deep shadows on the south side, and the homes perched along the north side. Between the houses and the road is the pipe line which carries the hydrogen and oxygen down to Rjukan in the background.

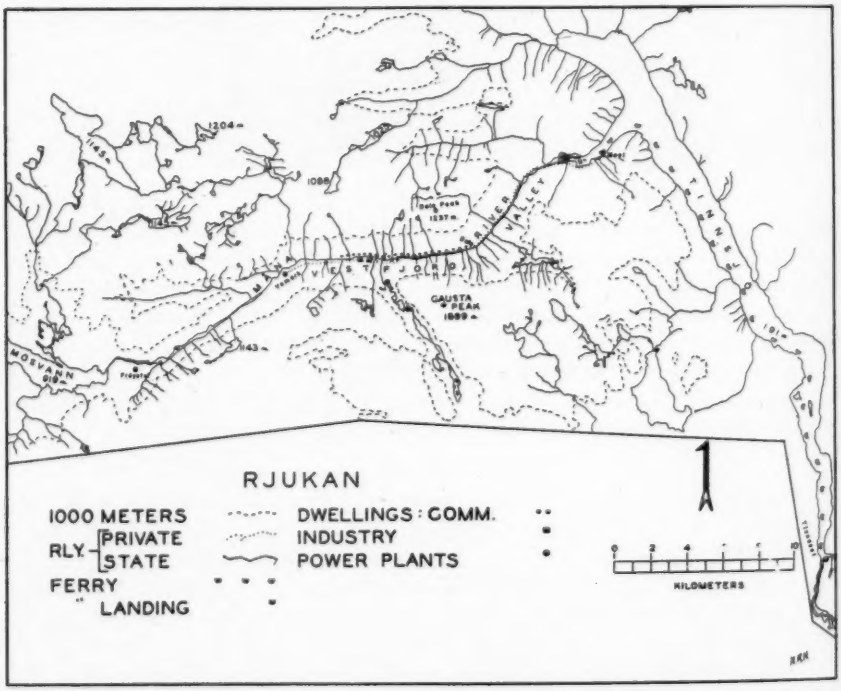


FIG. 9.

habitation is strung out along the Måna River which leaves only a very narrow strip of usable land between its plunging waters and the towering valley walls beside it (Fig. 8). So narrow is the area that considerable housing has had to be built up along the steep valley sides. Figure 9 shows that the dominating physical feature is the Vestfjord Valley with two lakes, the 900 meter high Mösvann on the western extremity, and the 190 meter high Tinnsjö on the eastern extremity. The connecting link between the two lakes is the Måna River which has a fall of some 700 meters in approximately 28 kilometers, most of which occurs in the western half of the valley.

Hydroelectric Power Development

Electricity generated by means of water power is here the key to the creation of one of Norway's largest industrial enterprises in one of the most sparsely populated areas in the country. Mösvann stretches some 40 kilometers westward into the rugged bleak Hardangervidda and serves as a natural regulating basin for the Måna River with a catchment area of some 1498 square kilometers.[8] Today the lake has a dam across its outlet with a regulating height of 18.5 meters, creating a storage basin with a 1058 million cubic meter capacity. There are in the Vestfjord Valley, between Mösvann and Tinnsjö, three large power plants,—Fröystul (25,200 kW.); Vemork (140,400 kW.); and Såheim (116,900 kW.) (Fig. 9). Prior to any industrial development in the area the Måna River ran full and plunged as a wild thing over the famous Rjukan falls which were located near the present site of the Vemork Power Station. Today little water traverses the steep rocky course of the river bed and the ravine near Vemork no longer encases those plunging waters once among the famous sights of Norway.

The first power plant, Fröystul, lies high in the mountain valley just two kilometers below Mösvann. The water is shunted directly from the lake, by means of a tunnel, to a point just above the power plant where it has a gross head of some 51.25 meters. After being used for the generation of 25,200 kW. of power, the water continues its way down the valley for 5 kilometers to Skarsfoss where a 120 meter long dam has been built. From here a tunnel is again used to carry the water through the mountain for 5.5 kilometers to a regulating basin above the Vemork Power Station. Figure 10 shows the fan like deposits of rock which resulted as the excavating for the tunnel proceeded. From the diversion reservoir the water is dropped by means of eleven huge penstocks to the Vemork Power Station, about 295 meters below, where it is used to generate 140,400 kW. There is yet a third stop on the journey to Tinnsjö. Another tunnel conducts the water approximately six kilometers farther down the valley to Rjukan and the Såheim Power Station. Here there is a gross head of 267 meters with a power capacity of 116,900 kW. In a series of three steps the waters dammed up by Mössvann are dropped some 613 meters within a distance of a few kilometers creating a power production of 282,500 kW.

[8] Norges Vassdrags og Elektrisitetsvesen, *Utbygd Vannkraft I Norge.* (Oslo: H. Aschehoug & Co., 1946). Tabell III, p. 49.

FIG. 10. Looking east across Vestfjord Valley. The valley floor is approximately 780 meters above sea level. Notice the small amount of water in the river and the fan-like deposit of rock debris in the center. The deposit of rock is due to the excavation for the tunnel which passes through the mountain at this level.

In such a glaciated area there are many rivers and lakes capable of utilization for hydroelectric power development. There has just been completed an elaborate system of dams and tunnels which connects a series of these lakes and rivers (the Mår River is the largest) and a 17.3-kilometer-long main tunnel carries the water over to the Vestfjord Valley. A diversion reservoir is located underground beneath Dale Peak which is on the north side of the valley just opposite Gausta Peak (Fig. 9). From here a pipe, 1250 meters long, runs at an angle of 40° and drops the water 824 meters down to the station at Dale where it generates some 144,000 kW. An interesting aspect of this construction is that the diversion reservoir, the pipe tunnel, the power station, and the transformer chamber are constructed completely underground in solid rock.

Industrial Activities

Another significant difference between Rjukan and Odda may be stated. In Odda there are four industrial plants operating; here in Rjukan there is but one, Norsk Hydro. This company owns and operates all power facilities (except the state controlled Mår) and industrial plants. It also owns most of the Vestfjord Valley which includes Rjukan, and it owns and operates the Rjukan railroad and the ferry on Tinnsjö. From the outset the company planned and built all the industrial and residential sections and it is today constructing new apartments for the retiring employees. As Rukan is in existence solely for industrial purposes, its

commercial, wholesale, and political functions are at a bare minimum. It is not a political unit, but merely a concentration of population within the parish of Tinn. It has fine medical facilities which are company sponsored. There are the usual run of retail facilities taking care of the daily necessities of life. Recreational diversions have also been planned and provided by the company.

The reason for this development is the production of Rjukan's main commodity, Norwegian nitrate of lime (Calcium Nitrate Norge) which has a 15.5 per cent nitrogen content. Other products manufactured are highly concentrated nitric acid, used in the manufacture of ammunition, dyes, etc.; nitric acid of lower concentration and in various stages of purity; inert gases—argon, neon, helium, etc.; and dry ice.

The starting point in the chain of reactions which must occur before the main finished product is produced, lies at Vemork. Here, immediately in front of the power station, has been built a huge electrolysis plant where the necessary hydrogen is produced by the electrolysis of water. The production rate is some 20,000 cubic meters of hydrogen and 10,000 cubic meters of oxygen per hour. The gases are then piped directly to the factories in Rjukan. 12,000 cubic meters of hydrogen per hour are also manufactured at Såheim and are sent to the ammonia plants in Rjukan. Nitrogen is obtained through the Linde process. The two raw materials nitrogen and hydrogen are then mixed in the proportion of three volume units of hydrogen to one of nitrogen and are passed through several processing stages to produce liquid ammonia. Two-thirds of this liquid ammonia is placed in tank cars and shipped to the company's nitrate factories at Eidanger on the southern coast (Fig. 1). The remaining one-third is converted at Rjukan into nitric acid in which

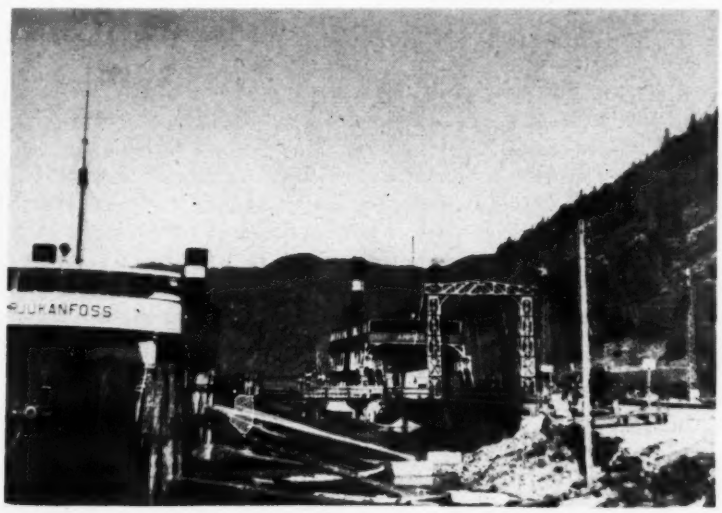


FIG. 11. Mael ferry dock showing the railroad-ferry connection to Rjukan.

limestone is dissolved. The resulting product is filtered, evaporated, and converted in a congealing tower to a solid calcium nitrate which resembles hailstones in form. The finished product is then automatically packed into impregnated bags, date stamped, and sent to the railroad yard by conveyor.

Transportation

Rjukan is connected with the outside by rail and motor road. There are good bus connections into the valley, and the roads are highly passable for automobile traffic (Fig. 9). Most materials, however, are hauled in and out by rail. The Rjukan-Mael railroad, which runs from the Vemork Power Station to the Mael ferry dock, is owned and operated by Norsk Transportaktieselskap, a subsidiary of Norsk Hydro (Fig. 11). From Mael, ferries, owned by the same company and equipped to carry railroad cars, make connections with the state railroad at Tinnoset approximately 30 kilometers away at the southern tip of Tinnsjö. Coming into Rjukan are the myriad of articles needed to satisfy the wants of some 5500 individuals. Everything must be shipped in from the outside since this narrow, rocky, mountain valley is prolific in nothing except its hydroelectric power development. In addition to the material needs of the inhabitants, all machinery and equipment for the factories and power plants must be brought in over this transportation system. The main raw material is limestone which is shipped up from the quarries at Kjørholt on the southern coast just south of Eidanger. The product, liquid ammonia, is shipped out by tank cars to the Eidanger nitrate factories at Herøya, just west of Eidanger. The Calcium Nitrate Norge is shipped out by railroad car to the shipping facilities at Menstad; from here it is sent to foreign and domestic markets.

As the term "industristeder" implies, both Rjukan and Odda are first and foremost areas of industrial development, all other activities being subordinate. Moreover, these are two industrial areas utilizing some 48 per cent of the total water power used in the country by the electrochemical and electrothermal industries. Development and expansion are in progress and probably will continue. The future naturally is closely tied to world markets and the harnessing of more water power. It is doubtful whether there will be any tremendous growth in the size of population of the two places for their industries do not require large numbers of laborers.

However, it has not been the purpose here to forecast the future of these industristeder, but rather to indicate their nature as industrialized areas not possessing city status. Here have been described two centers of population, each possessing a population comparable in size to that of many Norwegian cities, each carrying on essentially urban functions, and each dependent upon industrial production for its sustenance. These settlements are only two among thirty-seven such areas recognized by the Norwegian census. They serve as indicators to one possible explanation for the rurally classified industrial workers.

THE NETHERLANDS DEMANDS ON GERMANY: A POST-WAR PROBLEM IN POLITICAL GEOGRAPHY*

GEORGE W. HOFFMAN
University of Texas

THE Netherlands claims for numerous changes along her 525 km boundary with Germany, and various claims in the economic sphere which arose at the end of World War II, add one more problem to the political geography of the post-war period[1] (Fig. 1).

The Dutch frontier rectification claims are part of a whole series of border changes demanded by Germany's western neighbors at the end of World War II—France in the Saar, Luxembourg, Belgium, and the Netherlands.[2] In spite of the number of people involved, the area and the resources concerned are relatively insignificant compared with the changes along Germany's eastern border. Nevertheless, the Germans regarded the proposed changes on the west as a most serious matter, of equal importance to the changes on her eastern boundary. Britain and the United States were quite willing to consider boundary adjustments on Germany's western boundary as long as they did not effect Germany's post-war rehabilitation and did not play into the hands of Russia's propaganda. The changes contemplated in the west add to the complexity of the European jigsaw boundary pattern.

The Netherlands demands were originally most extensive, but, through circumstances discussed later in this paper, they were reduced to relatively minor changes under pressure from the United States and the United Kingdom.

BACKGROUND OF THE CONFLICT

The demands by the Netherlands Government for certain boundary corrections and economic concessions can be traced to the damages caused during the war by

*A preliminary and abridged version of this paper was read before the *Association of American Geographers*, March 1951.

I gratefully acknowledge assistance from the Graduate Research Institute of the University of Texas for cartographic assistance for the preparation of the maps included in this publication.

[1] *Memorandum betreffende verlangens van territorialan en economischen und ten aanzien Duitschland.* 's-Gravenhage: 5 November 1946. p. 1. For details of the various claims presented by the Netherlands Government see also Memorandum dated January 14, 1947 and the very detailed *Additional Memorandum of the Netherlands Government with regard to the Future Netherlands-German Frontier and Related Problems.* The Hague: 25 January 1947, also *Memorandum to Deputy Foreign Ministers*, January 14, 1947.

[2] Colbert C. Held, "The New Saarland," *Geographical Review*, XLI: 590-605. Communication from Ambassade de Belgigue, December 7, 1950, together with official document entitled, *Comité des Frontièrs Occidentales de L'Allemagne*, 22 Mars 1949; *London Times*, January 10, 1947, March 28, 1949, April 15, 1949; *New York Times*, March 27, 1949 and April 16, 1949.

THE DUTCH-GERMAN BOUNDARY
DENMARK
EMDEN
HAGUE
NETHERLANDS
EMS
WESER
BELGIUM
BRUXELLS
AACHEN
COLOGNE
GERMANY
MAAS
RHINE
MAIN
LUX.
REIMS
SAAR
FRANCE
25 0 25 50 75 100 KM
0 25 50 MI
55
53
51
49
5
7
9

FIG. 1.

the Germans. As early as July 1944 the Foreign Minister of the Netherlands Government in Exile wrote "it may be found necessary to grant her (The Netherlands) an equivalent portion of German territory or at any rate the usufruct from it . . . Holland's population lives 640 to the square mile. The population density in Germany before the Nazis began their course of conquest was only 360 per square mile. [This figure, incidentally, put German laments over their need for 'Lebensraum' into proper perspective.] If Germany's course of destruction in Holland goes to such lengths that the Dutch people need additional land in order to live, some suitable form of compensation (if territory, then territory minus Germans) must be found . . ."[3] This statement was followed by an official announcement from the Government in October 1944 which, among other things, stated that "a suitable part of adjoining Prussian territory should either be ceded to the Netherlands or brought into the Dominion or economic orbit of the Netherlands in some other manner on a provisional or permanent basis . . ."[4] These two statements were followed by several Memoranda outlining in detail the various physical and economic demands and the problems connected therewith.[5] These Dutch demands include "1. indemnification for the losses and damages sustained, in the economic sphere primarily, and 2. frontier rectifications." Among the economic demands were (1) the handing over of German coal mining concessions between the eastern border of the province of Limburg and the Rhine (total of thirteen), and also certain unexploited layers of potassium near Wesel and Xanten; (2) abolition of all special rates on German railways, canals, also of port and transshipment charges, favoring the German seaports of Hamburg, Bremen, and Emden; (3) banning the construction of new canals which might deflect traffic from the Rhine into other than the normal channels, and also prohibiting the widening and deepening of existing canals of this nature; and (4) prohibiting the enactment of monetary policies which might discriminate against the Netherlands seaports, traffic, and trade.

In demanding certain frontier rectifications, it was hoped that the border would be shortened from 525 km to 340 km. According to the 1939 census 119,000 people lived in the territory to be ceded.[6]

Due to the general political situation in Europe and the postponement of a final treaty with Germany, only small frontier corrections were considered by the western powers. After considerable delay, the London Conference of June 1948 named a Working Comittee to consider provisional adjustments of the entire western frontier of Germany. The very limited frame of reference stated: "Only those proposals might be examined which involved no appreciable loss to the German economy and which, being of minor character only, could be regarded as

[3] Eelco E. van Kleffens, "If the Nazis Flood Holland," *Foreign Affairs*, XXIII: 543-551.

[4] Statement issued by the Netherlands Government 28th October 1944.

[5] Various Memoranda, *op. cit.* Footnote 1.

[6] *Memorandum*, November 5, 1946, *op. cit.* German sources in 1949 estimated that over 250,000 people, many from lost territories lived in this area.

desirable to eliminate local anomalies and improve communications."[7] The committee submitted, and the western powers approved in March 1949, thirty-one rectifications, of which nineteen were along the Dutch-German boundary. These rectifications total approximately 17,100 acres with 9,553 people.[8]

From this brief background it can be seen that two distinct problems were presented: 1) indemnifications for the losses and damages sustained, primarily in the economic sphere, and 2) frontier rectifications. In the end, the frontier rectifications were approved and formally undertaken, even though greatly reduced, and indemnifications for the losses and damages sustained were not considered at that time, but postponed until such time as a general peace treaty with Germany was under consideration. Even though many of the original demands of the Netherlands Government were disapproved or postponed, in order to present all factors, it is necessary to analyze the original demands, together with those finally approved.

THE ORIGINAL DUTCH DEMANDS

Between the fall of 1944 and November 1946,[9] various Netherlands Ministries were occupied with the preparation of very definite claims to be made against Germany. Basic arguments about the extent of these claims centered around the territorial demands. Certain groups supported the idea of large scale boundary adjustments, including the occupation of sections of Westphalia. Others were against any territorial changes and wanted to concentrate on indemnifications in the economic sphere only. As usual, a compromise ended these prolonged discussions. The Memorandum cited above bears the fruits of this compromise and laid the foundation for the first extensive territorial and economic demand on Germany by any Western power.[10]

This first Memorandum was supplemented shortly thereafter by a more detailed study, which was submitted on request to the deputy Foreign Ministers (France, U.K., U.S.A., and U.S.S.R.) who in January 1947, began working on a peace treaty for Germany.[11]

Both Memoranda discuss in great length the background of the Netherlands demands. The Memorandum dated January 1947 devotes much time to the historical aspects of the frontier region and comes to the conclusion "that the modi-

[7] *The Department of State Bulletin*, XX, 509 (April 3, 1949): 427.

[8] *Report by the Demarcation Commission of the Netherlands-German Frontier*. The Hague: December 1949.

[9] van Kleffens, *op. cit.*, and *Memorandum*, November 1946, *op. cit.*

[10] Information on which these statements are based was supplied to the writer by several Dutch officials during a visit to the Netherlands in 1948.

[11] *Additional Memorandum*, January 1947, *op. cit.* To this Memorandum various Appendices were attached including several maps delimiting the border rectifications demanded. No copies of those maps are available in the USA and upon repeated requests from the Hague the writer was informed that only "very few copies were made" and "it seems impossible to locate the appendices to the Memorandum." The attached map showing the frontier rectifications based on this Memorandum is therefore only approximate and based on the descriptions supplied in the various texts.

fications of the frontier proposed by the Netherlands are in agreement with the historical development of that frontier and that these proposals aim only at such alterations as will either serve to rectify former mistakes and omissions, or are required by new factors that have come into play."[12] Besides frontier rectifications, many in connection with an adjustment of the catchment areas, demands in the economic sphere form the core of both Memoranda, and are indeed the most important aspect of the Netherlands demands on Germany. These economic demands according to the Netherlands classifications fall into two groups and are briefly summarized in the following pages: Group I—Demands of general economic character, and Group II—Demands of a more specified nature.

Economic demands

The Netherlands Government explained the need for certain economic demands:

> The damage caused by enemy aggression and occupation has assumed such proportions that very special provisions for the restoration of the prosperity of the densely populated Netherlands are deemed essential. . . . In the future certain measures should be taken to make Netherlands economy less dependent upon its hinterland. For that purpose a more intensified industrialization of the Netherlands will be a prerequisite, demanding a broader coal basis. Furthermore, a guaranteed supply of potassium fertilizer will be necessary for agricultural purposes. It is furthermore evident that restoration of trade and traffic with Germany will always remain an indispensable factor for the country's return to prosperity. With a view to allow full scope to the natural advantages of the Netherlands with regard to the Hinterland, well defined and lasting guarantees will have to be obtained. . . .[13]

Coal and potassium concessions

The Memorandum demanded the handing over of six coal mines in production and seven undeveloped mines, all located between the eastern border of the province of Limburg and the Rhine. In two instances mines located on the river's left bank will have to be worked from the right bank. Together with actual possession of these mines (Fig. 2), the Netherlands Government wanted a satisfactory solution to problems of transport, labor, supplying of the mines with goods required for the exploitation, and the like. The mines are:

Mines in production:

1. Walsum (right bank of the Rhine), inclusive concession Neu-Eversael (left bank of the Rhine).
2. Diergardt-Mevissen (left and right bank of Rhine).
3. Rhein-Preussen (inclusive Rhineland).
4. Friedrich Heinrich (Inclusive Humboldt 1 and 2, Norddeutschland and Camp v).
5. Niederrheinische Bergwerke A. G. (inclusive Grossherzog von Baden, Ernst Moritz Arndt, Süddeutschland, Heinrich and Vluyn 110).
6. Sophia Jacoba (inclusive Erkelenz).

[12] *Ibid.*, p. 5.
[13] *Memorandum*, November 1946, *op. cit.*, p. 5.

Mines undeveloped:

1. Rossenray
2. Rheinberg
3. Alfred
4. Niederrhein (inclusive Boenninghardt and Veen).
5. Walther
6. "Deutscher Fiscus" (north of Kevelaar)
7. Coallayers of Rombacher Huette near Erkelenz.

The Netherlands suggested the transfer of mines in production for a period of forty to fifty years, and an indefinite period to allow initiative for new exploitations for the undeveloped mines. It was hoped that ultimately up to 70 per cent of the Netherlands coal needs could be supplied from these mines. This would permit an increase in the industrialization of the country, and provide an added supply for the fast growing population—8.7 in 1938 to 10.3 million in 1952.

A short time ago the Government of the Netherlands and the German Federal Republic announced an agreement whereby the Dutch mining concession of "Melanie" will exploit the German mine "William Sophia" over a period of forty to fifty years. By this agreement approximately 300,000 tons of hard coal will be added to the Netherlands production, a small but significant amount, considering the total Netherlands coal deficit of six million tons.[14]

In addition to the above mentioned coal mines, the Memorandum also laid claim to four German potassium concessions in the neighborhood of Wesel and Xanten (Fig. 2). These are:

1. Gewerkschaft Rheinberg
2. Rossenray and Neu-Eversael
3. Zeche Friedrich Heinrich
4. Gewerkschaft Friedrich Thyssen.

Abolishment of special rates encouraging German ports

Unfair competition by German ports, special rates on railways, canals, port charges, and transshipment charges were listed by the Netherlands Government as detrimental to the development of Netherlands ports. In the words of the Netherlands Government everything should be undertaken to prevent interference by the German Government "with the natural flow of traffic," meaning that Holland is the natural transit area for Germany with the ports of Rotterdam on the Rhine estuary, its most important outlet. The Netherlands government proposed in this connection the creation of special machinery to control the whole German transportation system.

German Canals.

Closely connected with the special rate question is the Netherlands' demand insisting on the prohibition of the construction of "new canals which may deflect

[14] Official Announcement of the Netherlands, "Nederland Mag in Duitsland Kolen Delven." Maasbode, January 19, 1952.

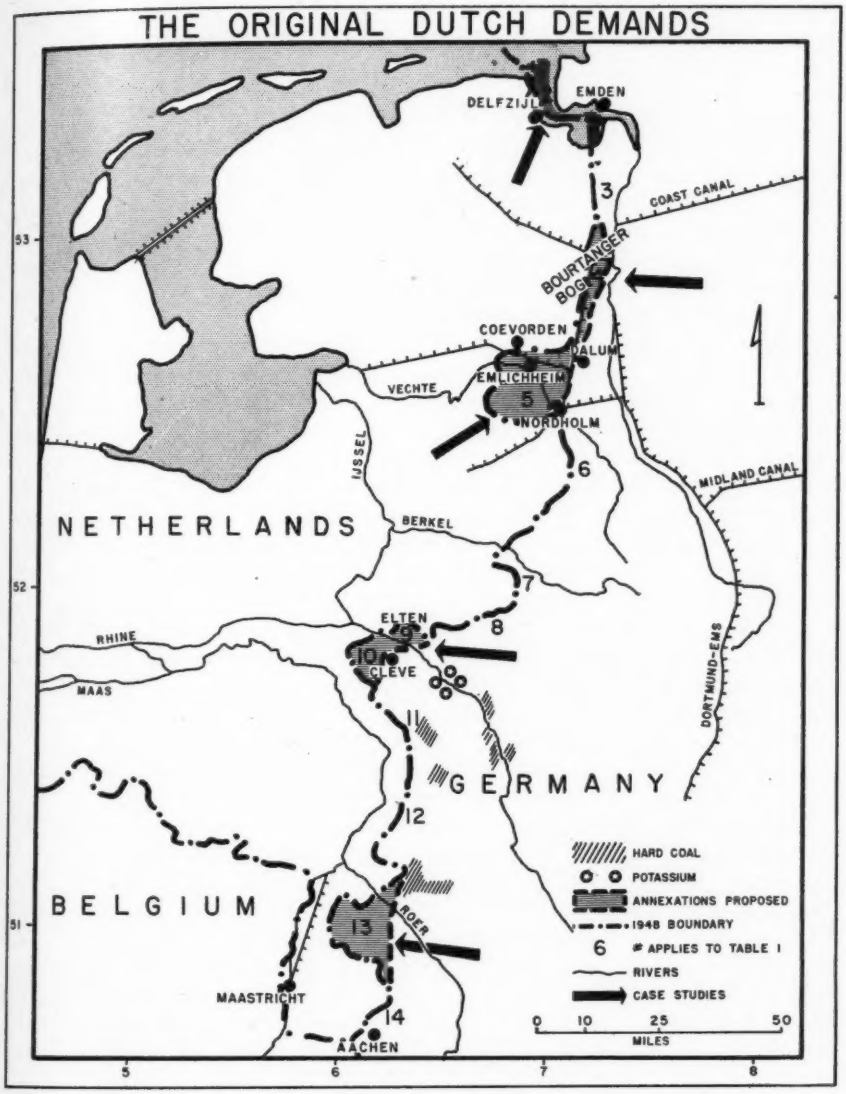


FIG. 2.

traffic from the Rhine into other than its normal channels, whilst furthermore the existing canals of this nature should not be widened or deepened."[15] Canals espe-

[15] *Memorandum*, November 1946, *op. cit.*, p. 7.

cially affected by this demand would be the Dortmund-Ems and the Midland Canal. Also, the construction of the projected canal between Osnabrück and Hamburg (Hansa Canal) would be prohibited.

Control of the German Monetary System.

Great concern is expressed regarding German discriminatory measures against Netherlands' seaports, transport, transit traffic, and overseas trade, especially since 1931. The main objective of the Netherlands is to obtain foreign exchange through German exports passing through Dutch ports. "All services connected therewith be paid for effectively." The services mentioned include Rhine traffic and other transport services, port charges, transshipment and storage charges, freight charges, commission profit margins, and the like.

Behind all of these demands was the Netherlands' great concern for its future as a vital link in international commerce. Because of the war damages brought about by Germany and the total breakdown of the Dutch economy, Germany was expected to contribute to the rebuilding of the Netherlands economy. Coal and potassium concessions, abolishment of rates detrimental to Dutch ports, canals which might deflect traffic of the Rhine into other than its normal channels, and participation in acquiring German foreign exchange were the main points of the Netherlands' demands. It was hoped that granting of these demands, together with contributions by the Dutch people themselves, would permit increased prosperity for the Netherlands.

British and United States occupational policies in Germany as late as 1950, especially those of the latter nation, encouraged German shipments to its North Sea ports, and continued Dutch apprehension was voiced about the damage such policies might do to its own ports. The Dutch, themselves, pointed out the inconsistency of the United States helping through European Recovery funds on the one hand and at the same time encouraging German discriminatory trading policies, which affected adversely the Netherlands' recovery.[16]

As was pointed out so clearly to this writer in 1948 by the Mayor of Rotterdam, when viewing all the destruction brought about by the Germans on the city and port area, "We Dutch hate the Germans for all the destruction brought about in the name of German superiority. But look at our dying port. Rotterdam is in need of a prosperous Germany; it is our hinterland. Without a prosperous Germany, Rotterdam and all of Holland can never prosper." These words point out more clearly than anything else the dependence on Germany of a prosperous Holland. The Netherlands economic demands stress clearly the dual problem of controlling certain German actions in the field of political economy and at the same time

[16] United States officials in Germany gave as defense of their actions the need for balancing the occupational costs and saving foreign exchange. Shipments from Germany through foreign ports must be paid in foreign exchange, while shipments through German ports do not require foreign exchange. In the case of military, shipments can be charged to occupation costs and do not come out of Army appropriations. An agreement satisfactory to all parties concerned was finally drawn up and ratified in late 1950.

encouraging the rebuilding of German trade channels and increasing Germany's earnings in foreign exchange, which would indirectly benefit the Netherlands.

Frontier rectifications

The demands for border annexations (first called annexations, later corrections —Dutch *correctie* or *verbetering*) according to the Netherlands Government, were guided by the following principles: (1) shortening of the frontier line, (2) improvement of local communications, (3) local improvement of canals and waterworks, (4) social and economic improvements, and (5) redress of local anomalies.

The Dutch hoped that the border could be shortened and that as few Germans as possible would be incorporated into the Netherlands. Holland was interested in the acquisition of land, not additional people. Because most of these demands have until recently been rejected by the Four Allies, and because the writer does not see much possibility of their being granted to the Dutch in the near future, only a brief survey of the most important original changes proposed is presented here. A summary is also presented in Table I.

Dollard and The Ems Estuary.

The Dutch themselves consider the changes proposed in the Dollard and the Ems estuary (No. 2 on Fig. 2) as their most important boundary claims. They had hoped to reclaim additional land, build a new and more dependable shipping channel to Delfzijl, divert the Ems-channel, and incorporate the Island of Borkum which controls the entrance to the German port of Emden. As can well be understood, the Germans were quick to point out the German character of the Island, long established ties to the former Bishopric of Münster; also the importance since 1433 of Emden as a port, and the lasting damage the Dutch plans would do to the port and its Hinterland. Schwind, in his study, points out that the problem of the Dollard, the Ems estuary, and the Dortmund-Ems Canal, is largely a problem of the future of the city of Emden and its hinterland.[17]

Bourtanger Bog.

Other changes proposed by the Dutch include border rectifications along the Bourtanger Bog (No. 4 on Fig. 2). The Dutch give the following reasons for the proposed changes: sparse population and economical neglect by Germans; need for additional drainage works; local custom anomalies; and large scale use of Dutch labor for cutting the peat on German territory. Contrary to this, the Germans point to the great advances made since 1919 in reclaiming the bogs. Only 15 per cent of the total Bog area is now considered unproductive. The whole area, with a total acreage of about 133,400 acres, is newly colonized land where 47 per cent is pasture and forest and the rest is used for the cultivation of various cereals. The use of Dutch labor is defended as a natural process in many border regions.[18]

Bentheim.

Officially the Dutch demanded only the straightening of "the curve in the boundary line near Bentheim" (No. 5 on Fig. 2). But in straightening this boundary line some of Germany's most important oil fields, the Emsland Fields, con-

TABLE I

The Netherlands—German Boundary: The Original Dutch Demands, 1947*
The Dutch and German Reasoning

No.	Description & Name of Area to be changed	Area acres	Population 1946[1]	Reasoning	
				Netherlands	German
1	Borkum Is.	8,650.0	6,120	Needed for reclamation work. Improvements of shipping channel.	Historic German, population all and always German.
2	Ems estuary and the Dollard	148,100.0	..	Needed for reclamation work. Improvements of shipping channel.	Great damage to city of Emden and its Hinterland.
3	Canal zone (western part of Rheiderland)	6,670.0	1,500	Control of discharge, drainage, etc.	Working for both sides
4	Bourtanger Bog & territory along left bank of Ems river	112,800.0	40,000	Defective maintenance by Germans, reclamation.	Importance to German food-supply. Dutch claim basically incorrect.
5	Bentheim	140,000.0	31,000	Floodcontrol, canal regulations, reclamation works, etc.	Valuable agricultural land. Important Ems oil fields.[2]
6	Area near Gronau (Glanerburg)	86.5	1,850	100% resp. 75% Dutch investments in two cotton mills.	Valuable to German economy, employs 1200 German workers in 1949.
7	Area around Vreden	30,400.0	11,300[3]	Shortening of communications.	Valuable to German economy, good agricultural land, important clay deposits.
8	Suderwick and Anholt	5,550.0	2,800	Communication improvements. Custom anomalies.	German towns. Communication improvements work for both sides.
9	Area north of Emmerich (Elten salient)	12,350.0	9,100	Communication improvements. Rhine regulations.	Traditional German. Great value to German economy with industries and good agricultural land.
10	Area of Cleve	45,950.0	15,000	Reasoning very unclear. Presumably shortening of communications.	German territory. Economic importance.
11	Area along frontier near Geldern	4,692.0	600	Floodcontrol	Working for both sides.
12	Area of Kalten-kirchen-Elmpt	22,720.0	5,000	Floodcontrol	Working for both sides and small industries on German side. Some timber.

TABLE I (*continued*)

No.	Description & Name of Area to be changed	Area acres	Population 1946[1]	Reasoning	
				Netherlands	German
13	Selfkant	54,800	45,000	Shortening of communications. Minor economic importance to Germany. Some coal mines. Floodcontrol.	Great economic importance. Coal mines. Population employed in German mines further toward the northeast and southeast.
14	Area west of Aachen	9,880.0	18,000	No definite proposal. Straightening of borderline.	German population. Important industries, some coal mines, etc.
	Total	602,648.5[4]	187,270[5]		

* Due to absence of maps indicating Dutch claims, the territory demanded by the Netherlands is extremely difficult to delineate. Schwind informs me that he had access to some official Dutch maps. See footnote 11 in this paper. My information stating Dutch reasonings are compiled from various official Netherlands reports.

[1] German population figures are taken from Schwind, *op. cit.*, pp. 118–122. These figures, especially for certain areas are much higher than the corresponding Dutch figures. Schwind gives no sources for his population figures. In checking these figures with the official German census of this year, different figures, usually lower are obtained. Areas #4, 5, 7, and 13 have much smaller populations according to various Dutch reports.

[2] For details of these important claims see this paper pp. 137–140.

[3] The Dutch mention especially "thinly populated."

[4] The Netherlands Government does not give any figures. The corresponding German figure is 943 sq. miles.

[5] The Netherlands Government supplied only total population figures for 1939—119,000.

Sources: Compiled from the following sources:

Official Netherlands Memoranda, *op. cit.*, sources cited in footnotes 1 and 8; also material cited under footnotes 17 and 19 by Schwind and a brief Dutch survey.

tributing nearly 40 per cent, in 1951, of German petroleum production, would have resulted in a loss to Germany.[19] The German fields center around the towns of Emlichheim, Dalum, Georgsdorf, and Adorf in Bentheim. These fields showed proportionately the biggest gain of all German crude output in 1950–51.[20] The

[17] Outstanding among studies by German scholars is Martin Schwind, *Landschaft und Grenze*. Bielefeld: F. Eilers Verlag GmbH., 1950, pp. 14–33 and also "Der Raum um Emmerich und das Westliche Selfkant," *Berichte zur Deutschen Landeskunde*. Band 7, Heft 2 (Mai, 1950): 340–347. A brief Dutch survey in "Correcties van Nederland's costgrens," *Tijdschrift van het Koninkzijk Nederlandsch Aardrijkskundig Genootschap*, LXVI: 348–351. The official Dutch case is presented in great detail in *Additional Memorandum*, January 1947, *op. cit.*, pp. 9–13, 25–26.

[18] *Memorandum*, November 1946, *op. cit.*, p. 9 and Schwind, *op. cit.*, pp. 40–45.

[19] *Ibid.*, pp. 54–63. Articles discussing the importance of the Emsland petroleum fields are: Helga Gillmann, "Die Gewinnung von Erdöl in den Niederlanden," *Erdkunde*, III: 173–174; Erich Otremba "Deutschland auf der Suche nach Erdöl," *Die Erde, Heft* 3–4, 1949/50: 353–354; Alfred Posselt, "Das Emsmoor-Erdölgebiet," *Mitteilungen der Geographischen Gesellschaft Wien*, Band 90, Heft 1–2 (1948): 109–110.

[20] International Operation Issue, *World Oil*, July 15, 1951, pp. 134–135, 204–210.

important Dutch petroleum fields of Schoonebeek are located nearby and the derricks of both countries lie within 300 feet of the present boundary.[21]

Elten and Selfkant.

Two other demands presented a solution to the traffic problem. The straightening of the boundary line northwest of Emmerich, which would incorporate the Elten salient (No. 9 on Fig. 2) into Holland, and the straightening of the salient of Selfkant, north of Aachen (No. 13 on Fig. 2). Both of these demands were at least partially granted and are discussed later.

Over twenty border changes were originally demanded by the Dutch. The more important ones are all located on Figure 2. In Table I the changes demanded by the Netherlands have been listed together with the reasons given by the Dutch for the changes and the defense provided by the Germans. It should be pointed out that many individual changes have been grouped together.

Catchment areas.

In both the original claim and the report of the Demarcation Commission finally adopted by the western powers, much emphasis was given to the water drainage, reclamation, and land and water communications along the Netherlands-German frontier region.[22] The catchment areas of the various rivers and streams are described in great detail.[23] The main points of the Netherlands' argument are that very few of the catchment areas are "entirely within the Netherlands' territory," and that "the waters of these areas always flow towards the lower-lying Netherlands." The Netherlands points out that any changes on the German side affect the Netherlands territory. Among the Dutch proposals to be included in a Peace Treaty are 1) a regulation preventing inundations and high water levels detrimental to agriculture as well as the discharge of polluted or chemically or bacteriologically contaminated water from the one country to the other; 2) the cost of improvements and maintenance of the watercourse, and other works, serving exclusively the discharge of water from one of the two countries shall be defrayed by that country, irrespective of the country in which the works are actually carried out; and 3) the Netherlands therefore shall defray only the cost of such works in their territory as are necessitated by the natural state of flows and discharge of the catchment-areas concerned, the remaining costs being borne by the two countries in proportion to the extent of the catchment-areas in each of the countries.

[21] The Schoonebeek Fields are the largest in Western Europe and are filling about 35 per cent of the domestic demands during 1951.

[22] *Additional Memorandum*, January 1947, Part III, *op. cit.*, pp. 9–26 and *Report by the Demarcation Commission, op. cit.*

[23] Catchment areas described in these reports are from north to south: 1) Ems, 2) Schoonebekerdiep, 3) Overijsselsche Vecht, 4) Regge, 5) Others on the Overijssel border, 6) Schipbeek, 7) Berkel, 8) Oude Ijssel, 9) Rhine, 10) Border streams of Dambeek and Millinger Landwehr, 11) Maas: a. Niers, b. Eckelsche Beek, c. Geldernsch-Niers Canal, d. Lingsforter or Sandhoeksche Beek, e. Swalm, f. Roer, g. Worm, h. Vlootbeek, i. Roodebeek.

In summary, it should be stated that to date none of the economic demands have been granted (with one minor exception mentioned earlier) and the frontier rectifications and proposals in connection with the catchment regions demanded have been modified considerably by the western powers or have been put off until a Peace Treaty could be drawn up. Those corrections actually carried out are discussed in the following pages.

THE NETHERLANDS-GERMAN BOUNDARY

The Boundary[24]

The problems along the whole boundary may be divided between those situated north of the Rhine and those to the south (Fig. 3). The former boundaries of the Bishopric of Münster, the territory of the County of Bentheim, and the Duchy of Cleves on the one hand, and the United Netherlands on the other have remained fairly stable since 1559, the year the northern provinces yielded some of their power to a *Stadtholder*. Many areas along this boundary have only in recent times been settled and cultivated. Some of these areas were kept in barren condition for strategic reasons, the Bourtanger Bog for example. During the last twenty to thirty years settlements moved toward each other in these empty areas, and, because the Dutch and German methods and principles of reclaiming bogs differed, the boundary line is clearly visible on maps and on aerial photographs.[25] Other border areas in the region north of the Rhine are clearly delimited by such dividing lines as rivers or the margins of bogs and forests, but others are closely tied to neighboring Dutch lands. The irregularity of the northern border is reminiscent of medieval church property divisions, semi-independent duchies, independent manors, and borders of cities subject to the Imperial Government only (*reichsunmittelbar*). Difficulties in the border region became noticeable only recently, because many parts of the frontier in recent years assumed the character of a cultural or economic divide in uniformly settled country.

South of the Rhine major and minor changes continued until 1815, with the result that the present boundary is a sharp dividing line. The economic life had to be adjusted constantly. The borders of the Dutch provinces of Gelderland and Limburg underwent constant change between 1559 and the Vienna Congress in 1815. Control over the Maas river and the important river cities of Maastricht, Roermond, and Venlo played a decisive role in determining the exact position of

[24] Besides the more general historical studies, a number of scholarly papers concerned themselves predominantly with the area under discussion. Among those are: Ernst M. Klingenburg, "Die Entstehung der deutschniederländischen-niederrheinischen Raumes 1813–15," *Deutsche Schriften zur Landes- und Volksforschung.* Band 7. Leipzig: Hirzel, 1940; G. W. T. Omond, "The Question of the Netherlands 1829–30," *Transactions of the Royal Historical Society,* II, 4th series (1919): 150–171; Carl Woebeken, *Das Land der Friesen und seine Geschichte,* Oldenburg: Schulzesche Verlagsbuchhandlung, 1932.

[25] Schwind, *op. cit.,* pp. 41 ff states that the reclamation on the German side went much slower, but is now only about 15 years behind Dutch work. Along several parts of the Bourtanger Bog German cultivation work has already reached the boundary.

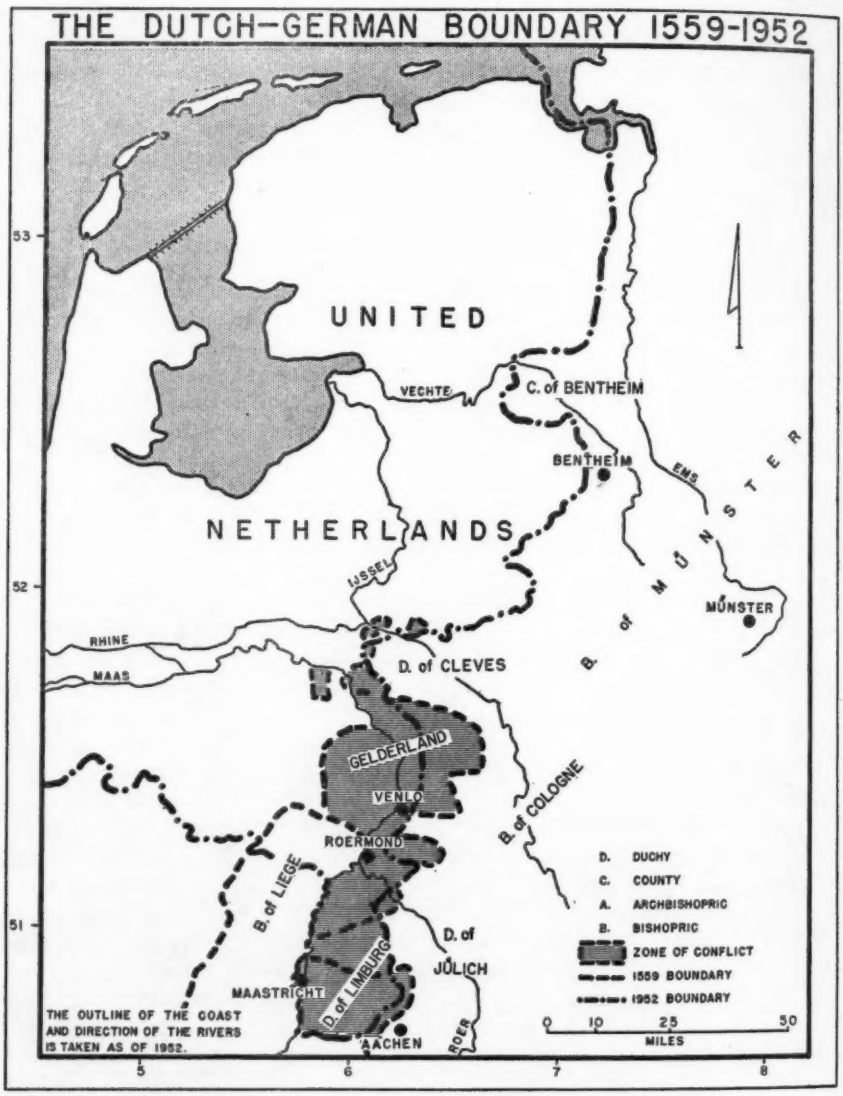


FIG. 3.

the boundary. The 1815 delimitation, largely based on political compromise, was protested by the Netherlands, but on the whole it has been satisfactory. The boundary was antecedent to the industrial development which followed.

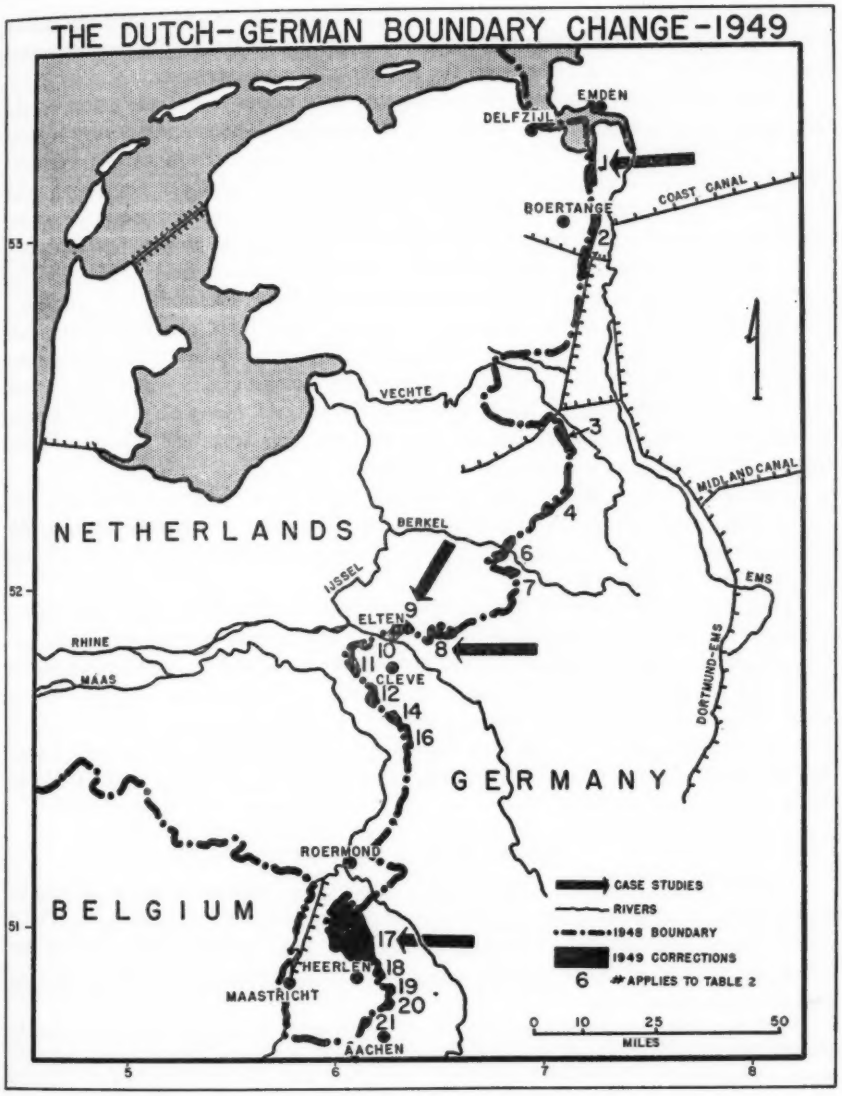


FIG. 4.

The Demarcation of the Boundary

The very irregular pre-1949 boundary ran in a general north-south direction from the Ems estuary to somewhat west of Aachen. Perhaps because of the absence

of a language barrier, and because of similarities in ethnic origin,[26] land utilization, house types, and occupations, many areas along the border do not impress the casual visitor with the differences between the Netherlands and Germany.

The boundary line in many places separates farmhouses from their fields, breaks villages in two, or criss-crosses rivers and farm roads. The specific border regulations set-up following the Vienna Congress of 1815 took cognizance of these conditions, when in Article 37 special regulations were enacted for facilitating border traffic.[27] These regulations, more than anything else laid the foundation for an intensive border traffic free from all formalities. All along the border, but especially near cities with industrial establishments, intensive cross traffic has gone on for some time. Some German border communities provide livelihood to a considerable number of Dutch workers, who now, often in their third generation, commute daily by bicycle to their German employment. Following World War II, because of policies pursued by the occupation authorities, border traffic was curtailed and only recently has it resumed its former proportions. All along the Dutch-German border, settlements extend across the boundary, trading areas are interwoven, and the people living in one country work in another.

During the last hundred years boundary lines have become increasingly important as dividing lines, and at the present time close integration in a border region becomes a handicap in custom control, river improvement schemes, reclamation schemes, and the like.

That was precisely the Dutch argument in proposing various changes along the border. The Working Committee, organized by the six western powers, agreed on nineteen corrections (numbered 1 to 21 on Fig. 4) along the Dutch-German border from the Westerwoldsche A in the north to the Vaals (west of Aachen) in the south (Fig. 4). Most of the corrections were of minor character. Little land and few or no people were involved, with the exception of an area east of Sittard, known as "Selfkant" (Table II, II–A–17), and Elten, northeast of Emmerich (Table II, II–A–9).

Classification of Corrections

Using the official report of the Demarcation Commission,[28] a series of detailed maps, aerial photos, personal observations at certain points along the border, Dutch and German studies, and comments supplied by the United States, Dutch, and

[26] The population is purely German, but was amalgamated from various tribes (Frisians, Franks, and Lower Saxons).

[27] "Die Ackersleute, deren Eigentum teils diesseits, teils jenseits der Grenze gelegen ist, können Mist, Stroh, Streu und sonstigen Dünger für ihren Ackerbau, wie auch jede Art ihrer eingeernteten Feldfrürchte aus-und einführen. Sie haben ebenfalls die Befugnis, ihr Weidevieh ein-und austreiben zu lassen, und zwar ohne irgendeiner Zoll-, seies Ein-oder Ausgangs-, Transit-oder dergleichen sonstigen Abgabe unterworfen werden zu können. Es ist hinlänglich, wenn sie durch ortsobrigkeitliche Atteste erweisen, dass sie jenseits der Grenze Eigentum besitzen und anbauen."

[28] *Report by the Demarcation Commission, op. cit.* This report included over fifty maps giving the exact survey of every boundary correction.

TABLE II

Netherlands-German Boundary: Population and Transferred Areas

Claim	Transferred			Population	Classification[1]
	ha	Sq. Mi.	Acres		
II-A-1 Westerwoldsche A			131	0	A
II-A-2 Boertanger Moor			54	0	A
II-A-3 Denekamp			20	0	B
II-A-4 Losser			378	18	A
II-A-6 Rekken				0	B
II-A-7 Ramsbeek			27	0	A
II-A-8 Dinxperlo			114	353	B
II-A-9 Elten			4,663	3,255	C
II-A-10 Milligen				0	B
II-A-11 Beek-Wyler			929	147	B
II-A-12 Sunken road Reichswald				0	B
II-A-14 I Hommersum			17	4	B
II Siebengewald (North)				0	B
II-A-15 Siebengewald (South)				0	B
II-A-16 I Arcan (North)			96	12	B
II Arcan (South)			82	12	B
II-A-17 Sittard-Selfkant			10,391	5,630	C
II-A-18 Waubach				0	B
II-A-19 River Worm			205	134	A
II-A-20 Kerkrade			20	0	B
II-A-21 Vaals				0	B
Total	6,931	26.	17,127[2]	9,553[3]	

[1] Classification Code:
A River Improvement Reclamation Schemes ..... 5 changes
B Custom anomalies ..... 12 changes
C Communications improvements (economic changes) ..... 2 changes

[2] Official figure is 487 acres which is obviously a mistake.

[3] Schwind, "Der Raum um Emmerich und das Westliche Selfkant," 340 gives only 9,200 population with 6,543 hectares (ha).

Source: Modified from Report by the Demarcation Commission of the Netherlands–German Frontier, The Hague: December, 1949.

German Governments, I have classed the nineteen corrections approved by the Demarcation Commission according to their main characteristics (Table II).

The nineteen border corrections can thus be broken down:

A. River improvements and reclamation schemes ..... five changes
B. Custom anomalies ..... twelve changes
C. Communication improvements (Economic changes) ..... two changes

The following are examples of the type of border corrections undertaken.

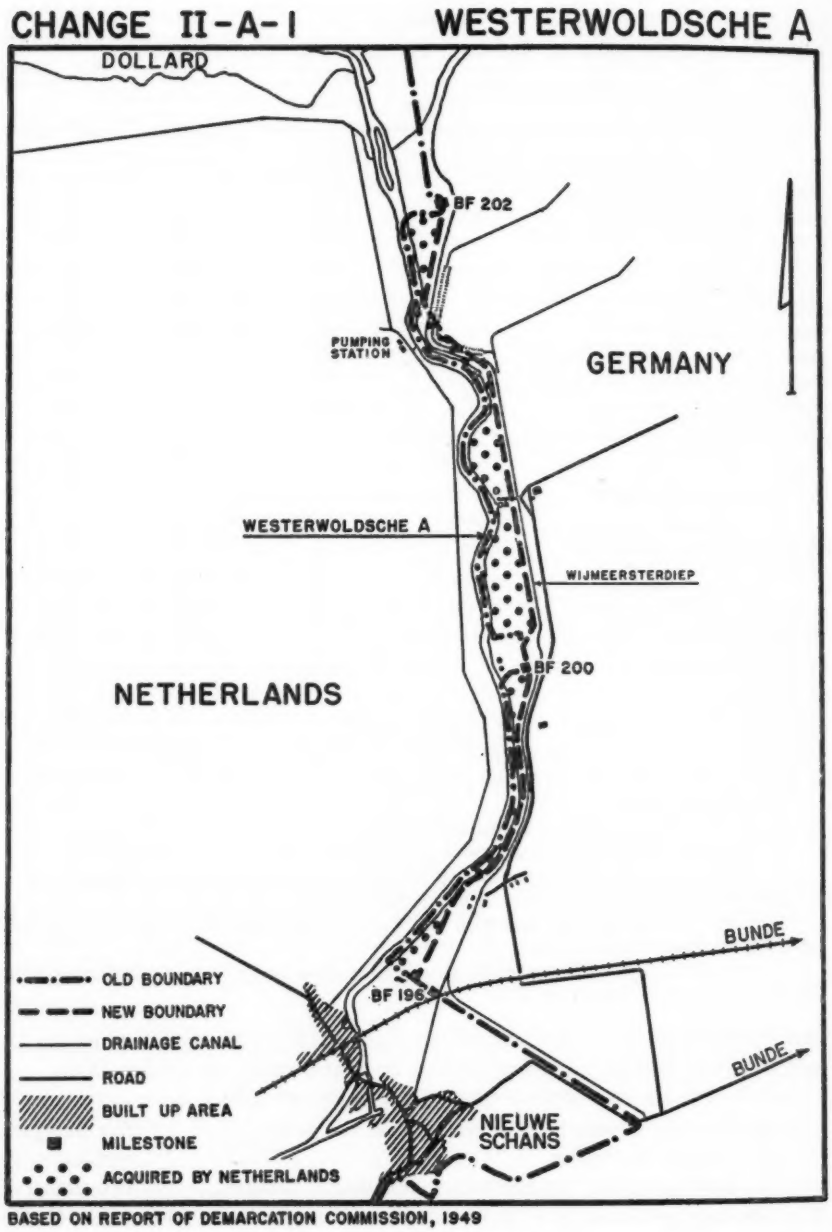
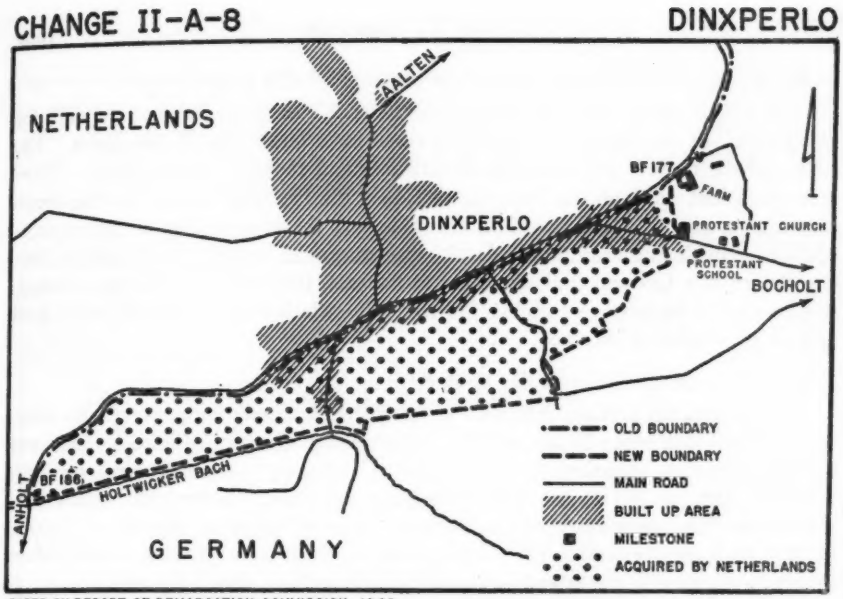
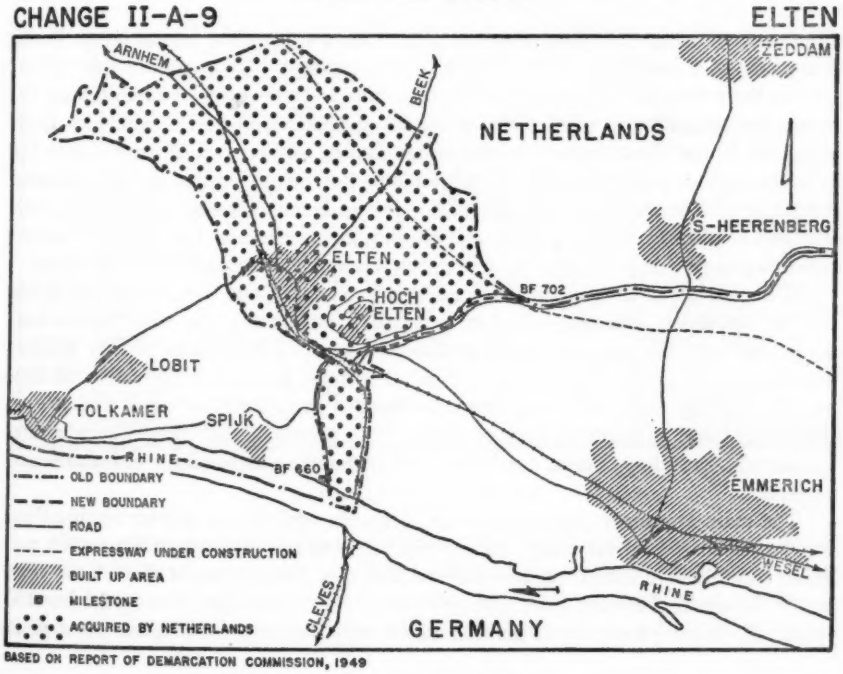


FIG. 5. Scale 1 : 38,385.



BASED ON REPORT OF DEMARCATION COMMISSION, 1949

FIG. 6. Scale 1 : 18,250.



BASED ON REPORT OF DEMARCATION COMMISSION, 1949

FIG. 7. Scale 1 : 101,230.

A. River improvements and reclamation schemes (Table I, II–A–1).

The Dutch stated that the "Westerwoldsche A" (Fig. 5) is used not only for navigation, but also serves as a drainage canal for a large part of Groningen. The course of the river is very winding in this area and requires straightening. There is not sufficient width on the Netherlands side of the Frontier to carry out the necessary improvements. It is therefore desirable that the frontier line be moved eastward to provide the area required. In the process of moving the boundary line, one stretch of a German drainage canal to the east, together with the embankment, will have to be replaced and slightly shifted. The whole area consists of polder land and no population is involved.

B. Customs anomalies (Table II, II–A–8).

In this area the frontier follows a street which is closely built up on both sides, the northern side being Dutch and the southern side German (Fig. 6). This was an unsatisfactory situation from the point of view of customs control for both countries and has led to intensive smuggling activities. Among the details considered by the Commission was the future of the Evangelical church and school, most of their membership living toward Bocholt. The boundary line was therefore drawn to the west of the school and church, leaving them with Germany.

C. Communication improvements and economic changes (Table II, II–A–9) Elten and (Table II, II–A–17) Sittard-Selfkant.

Elten Salient (Fig. 7). The salient of Elten, the commanding height below Bonn, is considered a landmark. The Dutch, in demanding incorporation of this salient, give as their reasons shortening the frontier line, improving of communications between the southeastern part of the province of Gelderland and the area of Lobit along the Rhine River, removing custom anomalies, and control of the sluice in the Wild River thus permitting the Netherlands authorities to protect the area situated northeast of Emmerich against flooding. The salient is crossed by the main railway and road from Arnhem to Emmerich and during the war the Germans started construction of a super highway to connect western Netherlands with Germany.

A discussion of the significance of Elten must point out the importance of the city of Emmerich, Germany's last city on the Rhine before this river leaves Germany, and also the last city on the undivided river. Ship tonnage of fifty millions passed here in 1938. Because of the rapid growth and industrialization of Emmerich, the city expanded away from the flooded area surrounding it and toward the wooded and agricultural area of Elten. The people of the villages surrounding Emmerich, including Elten, commute to Emmerich which offers industrial employment.

The main argument presented by the Germans against any border rectifications was largely based on the close relationship between employment in Emmerich and living conditions in Elten. It was claimed that any changes might disturb the close inter-relationship between town and hinterland which developed during the last 130 years. By cutting away the Elten salient, the only territory with higher elevation in

this immediate section of the Rhine floodplain, the future of Emmerich could easily be retarded. Dutch arguments are based entirely on shortening communications. They point out that 1200 to 1500 Dutch people commute daily to Emmerich and that an addition of 700 people commuting from Elten could hardly effect the future of industrial and commercial Emmerich.

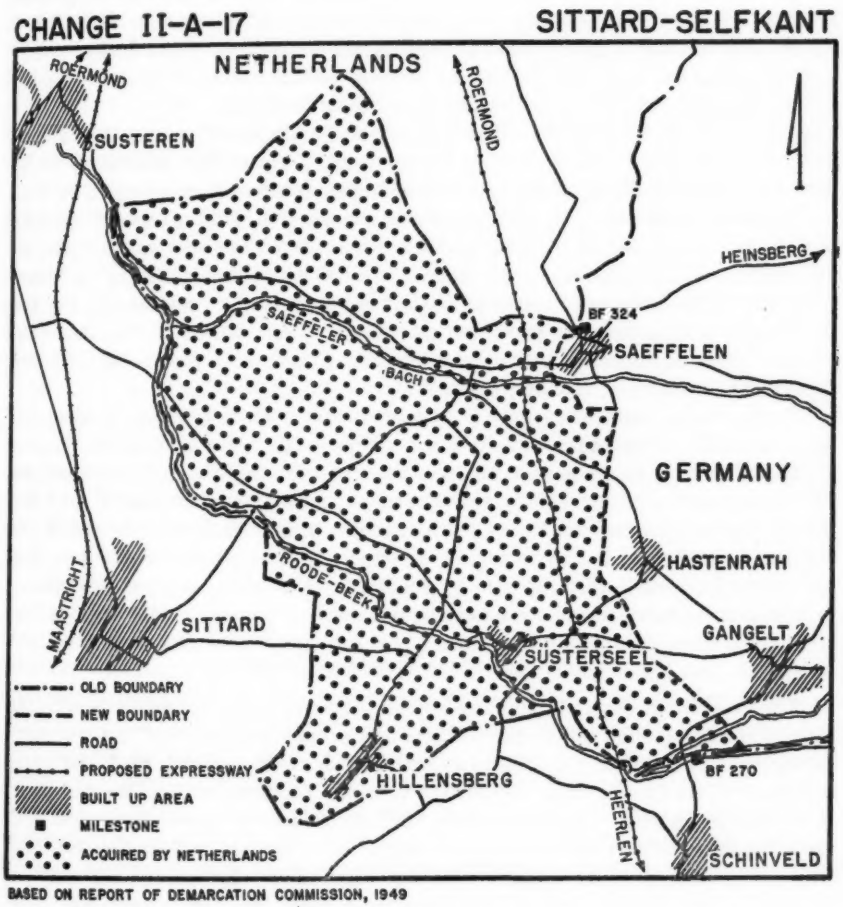


FIG. 8. Scale 1 : 91,000.

The incorporation of the Elten salient into the Netherlands added approximately 4,600 acres with a population of 3300. The occupations of its people are of two types: farming, largely potatoes and cereals for home use with some surplus for delivery to Emmerich; and manufacturing, with the supply of industrial workers to

the specialized industries of Emmerich, such as oils, fats, chocolate, pharmaceutical items, paper, machines, ceramics, and rooftiles.

In the original demand, part of the territory south of the Rhine, including the city of Cleve, was included. The main reason given was the need of a direct railway and truck road to connect Gennep (North Limburg) with Doetinchen (Gelderland) on the Oude Ijssel. The present route via Nijmegen, Arhem, and Doesburg is 68 kilometers long; the direct route via German territory, 37 kilometers. The Dutch stated that the development of the Geldersche Achterhoek (Doetinchen area) "where conditions both from the point of view of soil and population are highly suitable for the establishment of industries, is being held back . . ."

The Sittard-Selfkant (Fig. 8). The location of the "Selfkant" where the Netherlands territory is narrowest, leaving a bottleneck of about four kilometers width between it and the Maas which forms the Belgian frontier, was advanced in support of this correction. The Dutch are now planning to build a modern highway from Heerlen to Roermond[20] crossing the newly acquired territory west of Gangelt and Saeffelen. Of additional importance is the Hillensberg coal mine in the southwest, which has not been mentioned in Dutch reports. But considering the importance of coal concessions expressed in earlier requests by the Netherlands government, the acquisition of this mine containing considerable reserves presumably is part of the reason for claiming this area.

German arguments—strongest in regard to this correction—have pointed out that they (the Germans) would be quite willing to give Holland extraterritorial rights and permission to build a highway through the "Selfkant." In addition, the "Selfkant," with a predominantly agricultural population, supplies needed food and manpower to the Roer coal mines to the northwest and Aachen to the southeast. Further indication of the character of the population in this area is the fact that, during the first month of occupation by the Dutch, over 1000 passports were issued primarily for miners whose jobs were in Germany.

Summary of Significance of Changes

The first Dutch demands consisted of two parts: 1) economic demands with the main emphasis on the unfair competition of German seaports and the monetary regime, and 2) frontier rectifications a) based on shortening of rail, road, and water communications thereby acquiring certain valuable resources, such as the petroleum in the Bentheim area or the coal of the Selfkant, and b) problems concerned with the acquisition or correction of several catchment areas and reclamation projects. The last point emphasizes especially the possibility of reclamation and frontier corrections in the Dollard and the Ems estuary, a claim the Netherlands was especially insistent upon.

None of those claims was granted *in toto* by the western powers and Soviet Russia. After lengthy discussions among the western powers, especially after the

[29] Communication from *Netherlands Information Bureau*, New York dated November 15, 1950 and January 28, 1952.

Soviet Union expressed opposition to any change whatsoever, nineteen frontier rectifications along the Dutch-German frontier were approved.

Amidst misgivings by large sections of the British public, protests by the Russians,[30] and outbreaks of anger by the Germans expressed in statements such as "unilateral decision, counter to the Four Freedoms, and the UN Charter, self-determination," and also with considerable dissatisfaction by the Dutch Parliament,[31] the border changes were put into effect on April 23, 1949.

The actual transfer of territory proceeded without any disturbances. Dutch customs officials took up their new border stations and German citizen committees fully cooperated with the newly installed Dutch officials. While several German officials in nearby German cities protested against these arbitrary border changes, the areas affected hardly noticed the change of sovereignty.[32]

With the exception of changes in Elten and Selfkant, all other newly acquired territory was incorporated into the nearest Dutch political divisions. Elten and the Selfkant were administered by a special commissar, called *Drost,* who is responsible directly to the Minister of Home Affairs. The *Drost* has to consult the most prominent German citizen on local matters.[33] On January 1, 1952 the Selfkant territory was incorporated into the Dutch province of Limburg and the office of the *Drost* was abolished.

Most of the changes along the Dutch-German boundary are minor. Even the Sittard-Selfkant and Elten regions, changes 9 and 17 (Table II), have only 3,255 people to 4,633 acres and 5,630 people to 10,391 acres respectively. Most of these changes will bring only slight improvements to border regions, especially in regard to flood control, custom anomalies, and shortening of lines of communication. The land lost by Germany was mostly agricultural land, of considerable importance to the local German food problem.

The Dutch point of view, as expressed by their Foreign Minister during the debate before the Parliament, was that they tried for many years to reach a mutually satisfactory agreement, but that Germany refused to cooperate. Due to post-war Germany's increased strength, the Dutch were confronted with the possibility of attaining at least part of their goal now or never. Much opposition was expressed in the Dutch Parliament, especially in the Upper House. Some members were against any border changes; others thought the changes too small and insignificant. Some expressed the wish to concentrate demands on changes in the Dollard and the Ems estuary only, thereby pointing out the importance of possible reclamation work to the rapidly increasing population. The Government was able to carry its point of view by a vote of 25 to 17[34] approving the rectifications only

[30] *London Times,* March 28, 1949.

[31] *Minutes of the discussions before the Tweede Kammer,* April 5 and 6, 1949, pp. 1392–1417 and *Erste Kammer,* April 20 and 21, 1950, pp. 297–528.

[32] *New York Times,* April 22, 24, 1949.

[33] Communication from *Netherlands Government Information Bureau,* New York, October 26, 1950 and January 28, 1952.

[34] *Minutes Erste Kammer, op. cit.,* pp. 497–528.

after threatening to resign. Even though the margin of approval was narrow, Parliament prodded the Government to do everything possible to bring a solution on the economic demands satisfactory to the Dutch people. The problem of unfair competition of German seaports and the monetary regime was uppermost in their minds.

CONCLUSIONS

No strategic changes were actually approved, but at times it is difficult to differentiate between strategic, economic, and purely communication changes. The much rumored and discussed petroleum bearing region near the Coevorden-Piccardie and South-North Canal in Bentheim, bordering the important Dutch oil field of Coevorden-Oud Schonebeek, remained with Germany, even though it was part of the original Dutch demand.

In conclusion, one question stands out among the many problems of the Dutch-German border. In a land where the language of the people is so similar, their pattern of trade and occupation so closely interwoven, and the boundary line relatively long established, one wonders if these frontier rectifications enacted in April 1949 really improve the Netherlands' position. Invariably new problems along the border will arise for both countries, and the time will come when either the Dutch or the Germans will press again for frontier rectifications. Even today, the nineteen frontier rectifications enacted satisfy neither the Dutch nor the Germans. From both sides of the border voices can already be heard which again demand changes in the present boundary line.

OBSERVATIONS ON THE PHYSICAL GEOGRAPHY OF NORTHEAST BRAZIL*

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THE region known as the Northeast of Brazil is commonly described as one of poverty and hardship. For centuries its chief product has been people—people who migrated to other parts of Brazil where economic opportunity was thought to be greater. Workers from the Northeast panned gold in Minas Gerais, looked for diamonds in the interior, planted coffee in São Paulo, tapped rubber in the Amazon, harvested cacao in southern Bahia, and are now building factories and other buildings in Rio de Janeiro and São Paulo. The movement in and out of the Northeast goes on every year, but the outward movement is especially strong in the years of drought in the backlands. Large parts of the Northeast have suffered periodically from extremes of too little water or too much—disasters which Freise has described as "natural calamities."[1] Long before the arrival of the first Portugese settlers, the Indians of the region had preserved in their legends the story of recurring droughts.

To what extent is the widespread condition of poverty among the inhabitants of this region linked with the recurrence of natural calamities?

EXISTING INFORMATION

The published works on the Northeast are numerous, and some of them have been written by scholars of the highest reputation. In fact, the region offers a clear example of how numerous and substantial treatments of individual topics cannot be made to add up to regional understanding. Let us see why.

There are scholarly works on the Northeast in a wide variety of fields. The geological studies of John Casper Branner[2] are fundamental, and these have been supplemented in recent times by Jacques de Moraes[3] and Froes Abreu.[4] After 1909, when the *Inspetoria Federal de Obras Contra as Secas* (IFOCS) was set up

* Based on field observations carried out during the early part of 1950. The field party was sent out from the *Conselho Nacional de Geografia.* Its chief was Lindalvo Bezerra dos Santos. The writer was "technical consultant" to the Conselho. He was assisted by Ney Strauch and Antonio Guerra.

[1] F. Freise, "The Drought Region of Northeast Brazil," *Geographical Review,* XXVIII (1938) : 363–387.

[2] See R. Borba de Moraes and W. Berrien, *Manual Bibliográfico de Estudos Brasileiros.* (Rio de Janeiro, 1949). p. 363.

[3] L. Jacques de Moraes, *Serras e Montanhas do Nordeste.* (Rio de Janeiro, 1924).

[4] S. F. Abreu, "Nordeste do Brasil," *Boletim Geográfico,* I (1943) : 15–31; "As regiões naturais da Bahia . . . ," *Revista Brasileira de Geografia,* I (1939) : 68–76.

to coordinate the undertakings of the federal government in this region, a long list of studies has appeared dealing with geology, water supply, and natural vegetation.[5] Notable among these are the descriptions of the caatingas by Luetzelburg.[6] The climatic conditions have been described and interpreted by Morize,[7] Jefferson,[8] Delgado de Carvalho,[9] Sampaio Ferraz,[10] and Adelberto Serra.[11] The background of settlement and the development of culture have been treated by such masters as Oliveira Vianna[12] and Gilberto Freyre.[13] During the 1930's, the geographer Friedrich Freise[14] published a series of papers on the Northeast.

From all these writings what kind of information about the region can be compiled on maps? Amazingly little. In the first place geographical studies in the Northeast are handicapped by the lack of reasonably accurate base maps. Except for a few splendid topographic-scale maps by the *Serviço Geográfico do Exército* (Geographical Service of the Army) which cover only a small fraction of the region, and a few sheets of a map on 1/250,000 being prepared by the *Conselho Nacional de Geografia,* there is nothing available except the sheets of the International Map of the World and of the World Aeronautical Chart, both at 1/1,000,000. Lacking maps to show with sufficient accuracy the pattern of rivers, surface features, coastline, towns, and even the political boundaries, each writer has made use of base data which are not comparable with those used by others. Each has produced his own idea of the generalized patterns of the region, and since the several generalizations are shown with reference to different base data none of them can be used for the analysis of area relationships. Thus Luetzelburg's map of vegetation and land use can be compared with none of the other maps. Even the several rainfall maps of the Northeast are not comparable: in fact, Mark Jefferson's map of 1924 shows considerably more detail than the one by Freise published

[5] Consult the "Beitrag zu einer Bibliographie der 'Seccas' Literatur," *Ibero-Amerikanisches Archiv,* III (1929–1930): 99–105. Among the publications of IFOCS see especially the reports by R. Crandall, H. L. Small, and R. H. Soper dealing with geology and water supply.

[6] P. von Luetzelburg, *Estudo Botanico do Nordeste.* Publication Number 57, Series I, A, IFOCS, 3 volumes. (Rio de Janeiro, no date).

[7] H. Morize, *Contribuicão ao Estudo do Clima do Brasil.* 2nd edition. (Rio de Janeiro, 1927).

[8] M. Jefferson, "New Rainfall Maps of Brazil," *Geographical Review,* XIV (1924): 127–135.

[9] C. M. Delgado de Carvalho, *Dados Pluviométricos Relativos ao Nordeste do Brasil.* (Rio de Janeiro, 1922).

[10] J. de Sampaio Ferraz, *Causas Provaveis das Seccas do Nordeste Brasileiro.* (Rio de Janeiro, 1925).

[11] A. Serra, *Meteorologia do Nordeste Brasileiro.* (Rio de Janeiro, 1945).

[12] F. J. Oliveira Vianna, "O Povo Brasileiro e sua Evolução," in *Recenseamento do Brasil, 1 Set., 1920, Vol. I. Introducçao.* pp. 277–400.

[13] G. Freyre, *Nordeste.* (Rio de Janeiro, 1937).

[14] F. Freise, "Die Waldverhältnisse im Dürregebiet des Nordostens von Brasilien . . . ," *Zeitschrift für Weltforstwirtschaft,* IV (1936–37): 307–329; "Das Wasser im Dürregebiet des Nordostens von Brasilien," *Chemie der Erde,* XI (1937): 45–72, 223–248; "Beobachtungen an den Binnenlanddünen des Nordöstlichen Dürregebiet von Brasilien," *Petermann's Mitteilungen,* LXXXIII (1937): 135–137; "Inselberge und Inselberg-landschaften im granit- und gneisgebiet Brasiliens," *Zeitschrift für Geomorphologie,* X (1938): 137–168.

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THEAST BRAZIL
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Caicó
Rio Piranhas
Jardim do Seridó
PARAIBA
Patos
Barra
Campina Grande
Alagoa Grande
Cabedelo
João Pessoa

Iguatu
Souza
Araripe
Crato
Triunfo
Salgueiro
Cabrobó
Floresta
Jatina
Petrolandia
Petrolina
Juazeiro
Paulo Afonso Falls
Delmiro
Uauá
Canudos
Jeremoabo
Bonfim
Euclides da Cunha
Tucano
Jacobina
Rio Jacuipe
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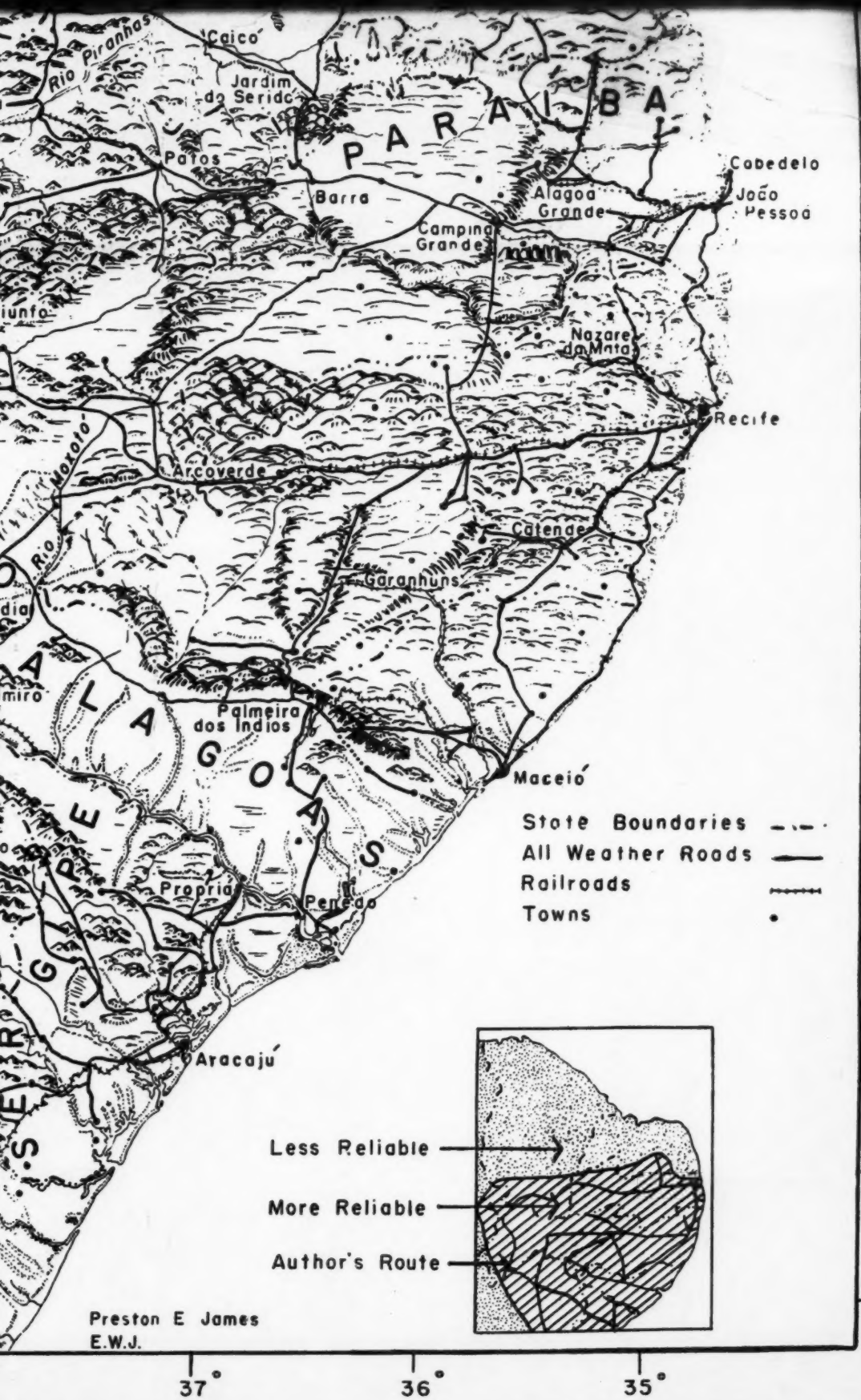
FIG. 1.


Rio Piranhas
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Recife
Arcoverde
Rio Moxotó
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ALAGOAS
Propriá
Penedo
Aracajú
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FIG. 1.

in the same periodical more than ten years later.[15] Now still different rainfall patterns are shown by the *Atlas Pluviométrico*.[16] Under these circumstances the published materials cannot be made to yield sufficiently precise understandings of the mutual relationships of the various significant phenomena which exist together in the region. Lacking such understanding, conclusions concerning the relation of poverty to natural calamities cannot be formulated with certainty, and physical engineering works for the mitigation of these calamities represent money spent blindly to remedy a condition which cannot be described and perhaps does not exist.

THE 1950 EXPEDITION OF THE CONSELHO NACIONAL DE GEOGRAFIA

The method to be used in providing significant regional understandings in an area lacking suitable base maps is, in itself, an important subject of study. A discussion of this problem is offered elsewhere.[17] The survey carried out by an expedition of the *Conselho Nacional de Geografia* in 1950, and the reports resulting from this expedition, offer an example of the application of geographic field techniques at the chorographic scale—that is where field observations are recorded on maps of 1/1,000,000, where the phenomena which are mapped must occupy at least nine square kilometers (four square miles) in order to be mappable, and where smaller features must either be overlooked or shown by out-of-scale symbols.

In simple terms, the method used consists of providing a map of one kind of feature to which all the other maps can be related. The primary map must present a feature which is easily observable in the field. Such is the map of surface configuration (Fig. 1) which accompanies this report. It was drawn on the framework of rivers and towns provided by the Aeronautical Chart, with highways and railroads corrected by compass and speedometer in the field. The perspective drawing technique was applied. While the precise position of the prominent surface features shown on this map will only be known after more accurate geodetic and photogrammetric work has been completed, they nevertheless provide a framework in relation to which the distribution patterns of other significant elements of the geography can be recorded on a comparable basis. All the other maps of physical, biological, or cultural phenomena, including maps of population density and land use not included in this paper, are drawn with the map of surface configuration as a base. When the surface features are revised in their positions, the other phenomena will be revised with them. But we have now at hand the means of analyzing the area relationships of the phenomena which exist together in this region, and of arriving at some new understandings regarding the problem of poverty and land resources in this important area.

The detail which appears on these maps should not be misinterpreted, it is provided by the direct observation of phenomena in the field, not each element

[15] Compare *Geographical Review*, XIV (1924): 130 and XXVIII (1938): 368.

[16] *Atlas Pluviométrico*. (Ministério da Agricultura, Departamento Produção Min., Divisão de Águas). (Rio de Janeiro, 1948).

[17] P. E. James, "Problems in the Use of Maps by Geographers," American Society of Photogrammetry (to be published).

separately, but all together in relation to the pattern of surface features—which in this area offers the most clearly observable base. This represents an application of the well-known methods of detailed survey to the more general problem of the chorographic survey. It offers data for the study of area relations gathered rapidly for a relatively large extent of country. It does not offer precise measurements, but only more precise relationships than could have been discovered previously where phenomena were not comparable due to the lack of a single frame of reference.

Divisions of the Report

The report on the field expedition of 1950 is represented in separate parts. This paper offers certain observations regarding the physical features of the land, the climate, and the pattern of natural vegetation. Another paper will present certain observations regarding the pattern of population and the kinds of land use.

The region known as the Northeast differs somewhat from the area included in the studies of Freise, and in the statistical divisions used by the *Conselho Nacional de Geografia.* This report recognizes the region as having its southern boundary some 80 kilometers (50 miles) north of Salvador in Bahia, and including all the country westward into the state of Piauí. The maps include the territory north of about latitude 12° S and east of about longitude 41° W (Fig. 2). In the Northeast are northern Bahia and eastern Piauí and all of Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, and Sergipe. The *Conselho Nacional de Geografia* uses the São Francisco River as the southern boundary of the Northeast, largely because the major part of the state of Bahia lies definitely to the south of this region, and for purposes of statistical computations it is desirable to keep the states together. Sergipe becomes "the forgotten state," since it, like the northern part of Bahia, is obviously a part of the Northeast yet statistically separated from it. All of this is only another example of the inadequacy of large statistical areas for purposes of geographic analysis.

The separation of the parts of the whole project in separate papers should not obscure the basic fact that the physical and the economic background of poverty are most intimately related. It is clear that not only have the physical and biological characteristics of the Northeast been profoundly altered by more than four hundred years of the destructive use of resources, but also that the attitude of the people toward the calamities of flood and drought is a result of inherited tradition and not the inevitable consequence of the calamities themselves. Continued emigration has had the usual result of developing an attitude of endurance and resignation among those who remain. It can be argued, moreover, that the calamities are not natural ones, but are man-made; they seem to be the result of the destruction of soil and forest. Poverty, then, would appear to be more closely linked to an economic and social system; and, while the floods and droughts of the region without doubt produce hardship today, this result is not inevitable. A solution sought by engineering works alone would seem to miss the root of the problem.

THE PHYSICAL CHARACTER OF THE NORTHEAST

The Northeast of Brazil consists of a complex basement of granites, gneisses, and quartzites from which a formerly widespread covering of sedimentary rocks,

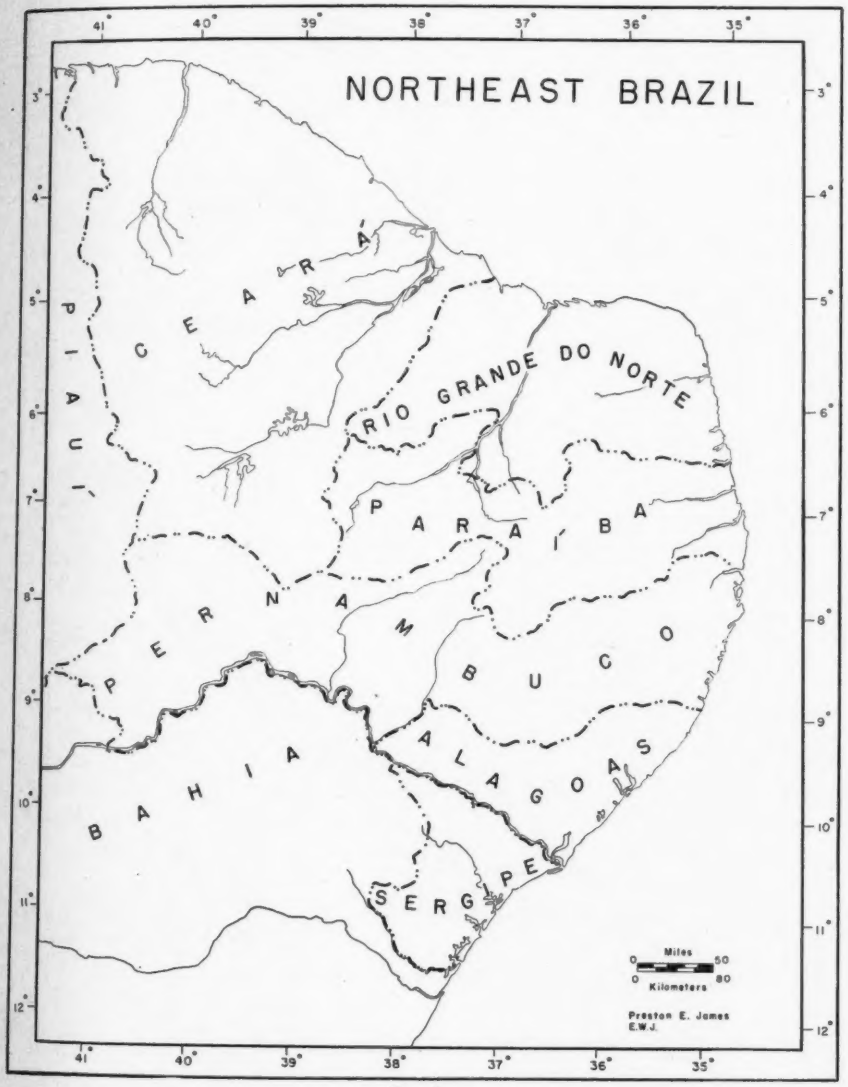

FIG. 2.

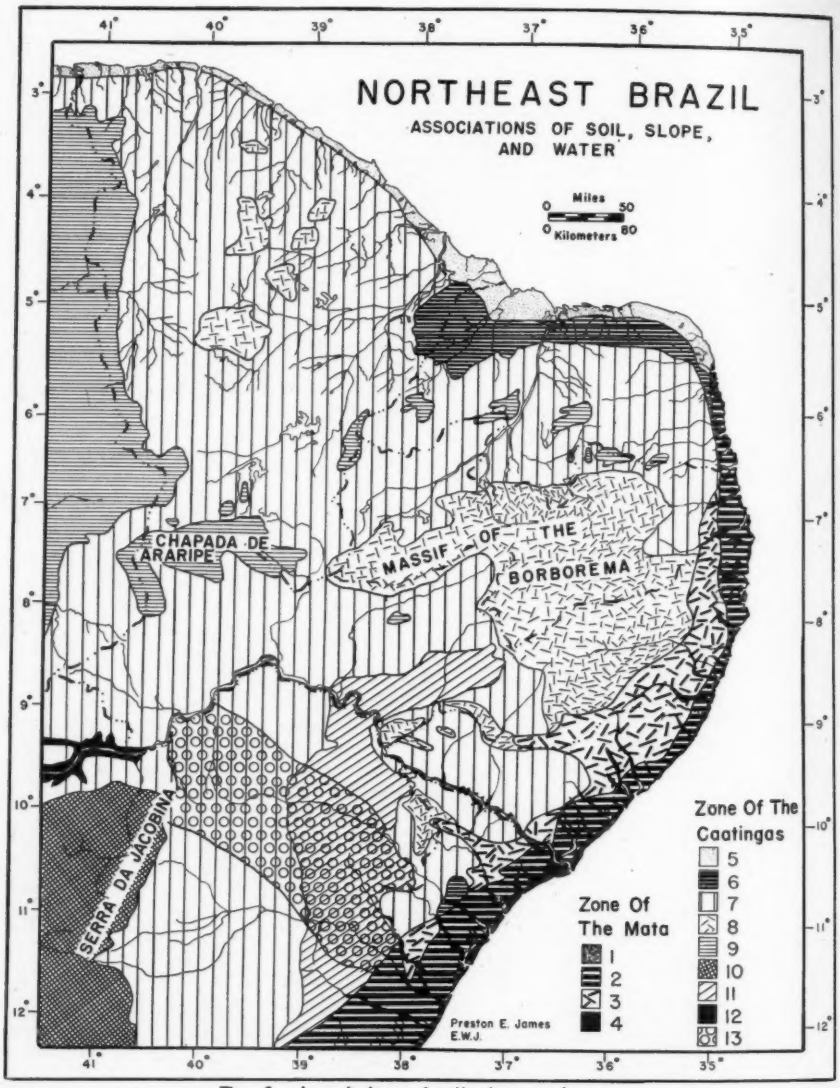

FIG. 3. Associations of soil, slope, and water.

Zone of the Mata

1 The Shore
2 The Taboleiros
3 The Hilly Lands
4 The Floodplains

Zone of the Caatingas

5 The Shore
6 The Taboleiros
7 The Broad Plains with Erosion Remnants
8 The Massifs
9 The Sandstone Cap
10 The Serra da Jacobina
11 The Sedimentary Basin of Bahia
12 The São Francisco Floodplain
13 The Itapicurú Drainage Way

chiefly sandstones, is in process of being stripped away. In places, the sandstone cap still stands commandingly above the lower crystalline plains—as in the case of the prominent sandstone cuesta along the border of Piauí and Ceará, and the outlying Chapada de Araripe on the border of Ceará and Pernambuco. There are other smaller remnants of the sandstone cap farther to the east. Stratified rocks also remain in a strip along the southeast coast, in a broad basin in Bahia and central Pernambuco, and in the synclinal structure of the Serra da Jacobina[18] (southwest corner of Fig. 3).

The crystalline rocks, however, are of greatly varying resistance to the forces of erosion. In some areas there are underlying rocks of great resistance which stand up prominently as *massifs,* the largest of which is the Massif of the Borborema in Paraíba and Pernambuco (Fig. 3). Some of the massifs, like the central part of the Borborema in Paraíba state, are only little dissected on their upper surfaces; but more of them are, like the margins of the Borborema, deeply dissected by streams. The areas of weaker crystalline rocks, on the other hand, have been worn down by stream action until they form broad plains which stretch away to the horizon with only a very gentle swell and swale. Yet above these broad plains rise many little quartzite knobs and hill clusters. Over large areas these knobs have the typical profiles of *inselberge.* The broad plains in Ceará rise gradually from the sea, and are described by Pierre Denis as constituting one of the few peneplains still essentiaily in place.[19]

The rivers of the Northeast seem to have been established in their courses on the overlying sandstone, and are now superimposed on the underlying crystallines. There have been certain geologically recent changes in drainage, as in the case of the lower São Francisco.

The complexity of the Northeast, however, is more than just the result of its underlying geologic formations and the erosion processes that have attacked these formations. There is also a major distinction to be made within the Northeast between the narrow band of dependable rainfall along the southeast-facing coast from Bahia to Natal in Rio Grande do Norte, and the backlands (*sertões*) where rainfall is lower and more uncertain. The humid band along the southeast coast is known as the *Zone of the Mata,*[20] or the forest zone (Figs. 3 and 4). It was originally covered with a tall tropical forest, of which no remnant remains uncleared. Judging, perhaps incorrectly, from the second growth which has appeared in some places, some of the forest was what the Brazilians call *mata da primeira classe* (first-class forest, wet semideciduous forest, Küchler BDtc),[21] and some of it, in drier places or on more porous soils, was a *mata seca* (dry forest, of semideciduous character, Küchler DBmc). There are "islands" of mata scattered in the higher

[18] J. C. Branner, "The Geology and Topography of the Serra da Jacobina, State of Bahia, Brazil," *American Journal of Science,* XXX (1910) : 385–392.

[19] P. Denis, *Amérique du Sud* in *Géographie Universelle,* XV, Part I. pp. 13, 89–95.

[20] V. Sobrinho, *As Regiões Naturais de Pernambuco.* (Rio de Janeiro, 1949).

[21] A. W. Küchler, "A Physiognomic Classification of Vegetation," *Annals of the Association of American Geographers,* XXXIX (1939) : 201–210.

areas of the backlands, where rainfall is relatively heavy and certain. Wherever there were originally forests, the soil is of a reddish or yellowish color, and on the granites and gneisses is predominently a clay; the landforms are rounded rather

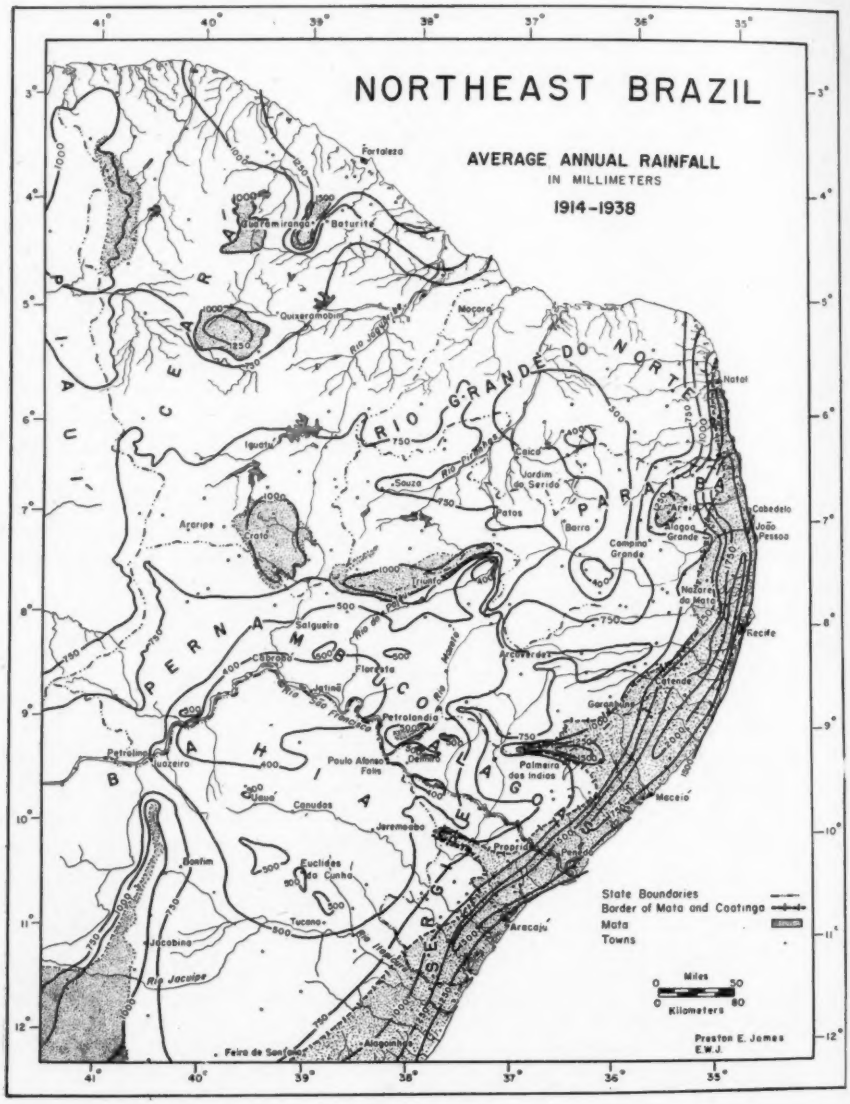

FIG. 4.

than angular; there is good ground water to be found at moderate depths and the streams are perennial.

The backlands, which are characterized by smaller average rainfall and greater uncertainty of rain, are known as the *Zone of the Caatingas*. Here the original vegetation was a scrub forest (of low thorny, deciduous trees and evergreen shrubs, Küchler DlHlpk). Wherever the caatinga covered the land, the landforms are angular; the soils are light colored and sandy or gravelly; and fresh water is at present difficult to find over large areas. Generally the zone of the caatingas receives less than 1,000 mm (40 inches) of rain a year, but there are many years when the rainfall departs more than 30% from the average.

The boundary between these two zones is remarkably easy to identify in the field, considering the fact that the vegetation cover has been repeatedly destroyed during four centuries of settlement. There are, to be sure, some places where a detailed mapping of soil types would be required in order to place the boundary with confidence; but in most places the difference is still clearly visible, and the zone of transition from one to the other is less than 10 kilometers (6 miles) wide.

The Zone of the Mata

There are four major associations of the elements of slope, soil, and water to be described in the Zone of the Mata. These may be briefly named as follows: 1) the shore; 2) the *taboleiros;* 3) the hilly lands; and 4) the river floodplains (Fig. 3).

The Shore

The whole shore from Salvador (80 kilometers or 50 miles south of the southern edge of the map) to the northern end of the Zone of the Mata just north of Natal is made up of sand bars, interrupted by only a few rocky headlands. The most prominent headland is at Cabo Branco in the state of Paraíba, the easternmost point of the South American continent. Most of the shore consists of wide, sandy beaches backed by rows of dunes. In a few places the bars have been cemented by deposit from the percolating waters, forming the famous stone reefs. The river mouths, especially south of the São Francisco River, have been drowned and rapid formation of bars along the shore has produced a string of lagoons, mangrove-filled where they are shallow.

The Taboleiros

Immediately behind the shore is a zone of varying width where sedimentary strata produce flat-topped mesas or *taboleiros*. The sides of the mesas are steep where they face the sea, or where the rivers have cut valleys through them. The tops are some 50 to 150 meters (150 to 500 feet) above the ocean.

It is probable that the original vegetation of the taboleiros was tall tropical forest, probably a mata seca in the north. The rainfall is very heavy—the heaviest in the whole Northeast. Today, however, repeated forest removal whether for charcoal or simply to create more pasture land, has resulted in a vegetation cover of coarse grass and scrubby trees. The soil is very heavily leached and eluviated;

it is sandy, deep, and porous, and water is not always easy to find near the surface. So poor is the soil that cattle grazing on the grasses suffer from bone deformity for lack of calcium.

The Hilly Lands

Where the underlying rocks are crystalline, entirely different landforms and soils are the result. These rocks are exposed inland from the taboleiros, and in the valley bottoms where the rivers cut through to the sea. These crystalline areas are hilly land with no very great relief, but with very little flat land. The slopes are concave and sharp-crested or convex and round-topped, presumably according to differences in the underlying rock. The bedrock, however, is deeply mantled with a clay or clay-loam, reddish or yellowish in color.

The hilly lands of the Zone of the Mata have been used for over four hundred years for the production of sugar cane, and during this long period there has been continuous soil erosion. Most of the cane is grown on slopes of more than 12°, some of it on slopes as steep as 25°. Although at present most of the hill-tops are left in a second growth of tall forest, heavy rains are inevitably accompanied by slides which cut steep, yellow gashes in the hill sides, bringing forest and cane together into the valley below.

The Floodplains

Floodplains, even along the lower São Francisco, are only narrow, often discontinuous bits along the valley bottoms. Yet few of the valleys fail to have at least a narrow ribbon of flat land subject to flooding along their bottoms. Such ribbons of flat land along the tributary valleys are presumably a result of accelerated erosion of the hilly lands due to destructive agricultural practices. All these floodplains present difficult drainage problems before they can be put to use for crops. The soils, however, where drainage has been carried out are among the most productive of the Northeast, especially in those valleys built by rivers draining from the Zone of the Caatingas, where the soil material which the waters pick up is less leached than in the wetter Zone of the Mata.

The Zone of the Caatingas

The greater part of the Northeast is in the Zone of the Caatingas. This is country which, in general, receives less than 1,000 mm. (40 inches) of rainfall a year, and which consequently has many angular rocky surfaces, has a soil which is sandy and light colored, and suffers from scarcity of fresh water. This general picture of the Zone of the Caatingas, however, omits important variations. There are numerous "islands" of heavier rainfall, once covered by mata. With the traditions of Portuguese agriculture, the settlers of the backlands were inevitably attracted to the forested slopes; after hundreds of years the destruction of forest has produced irregularities in the regimen of the streams draining these wet spots which, in turn, has modified the character of the valley bottoms. The drop in the level of the ground water table, resulting from the rapid run-off during heavy rains,

has numerous consequences not the least of which is the aggravation of the problem of water scarcity on the lower slopes and the plains beyond. All of this produces a condition of recurring flood and drought which cannot be considered as a part of the "natural" endowment of the region. The irregularities of the rainfall are a part of the natural condition of the area, but the destruction of the forest on the higher slopes greatly increases the irregularity of drainage, and greatly decreases the amount of water available for plants and animals.

There are several variations within the Zone of the Caatingas which are important to record. In the first place the caatinga itself is by no means uniform. There are places where it is so dense and tall that it approaches the kind of vegetation described by the Brazilians as *mata seca,* a vegetation type which is included in the Zone of the Mata. At the other extreme there are areas where the stunted, thorny trees are so widely spaced that there are extensive bits of bare ground with no plant cover at all—a condition which reflects the existence of a truly arid climate. An ecological study of the caatinga is needed, in which not only are the different plant associations described, but also the areas occupied by the associations are mapped. With such information at hand, the further study of soil, drainage, and other related conditions would yield specific understandings regarding the possibilities of more effective land use.

Within the Zone of the Caatingas there are also several divisions based on the associations of landforms, soil, and water. Nine such divisions are described and mapped (Fig. 3) as follows: 1) the shore; 2) the taboleiros; 3) the broad plains with erosion remnants; 4) the massifs; 5) the sandstone cap; 6) the sedimentary basin of Bahia; 7) the Serra da Jacobina; 8) the São Francisco Floodplain; and 9) the Itapicurú Drainage Way.

The Shore

As in the Zone of the Mata, the shore of the drier part of the Northeast is made up of long sand bars carrying strings of live dunes, and backed by marshy or mangrove-filled lagoons where the river mouths have been drowned. The sandy shore, with old beach ridges between marshy spots, is especially wide in Rio Grand do Norte and Ceará.

The Taboleiros

The taboleiros also continue northward beyond the forest zone, but only as far as the Rio Jaguaribe. They are especially wide and continuous in Rio Grande do Norte. The soils of these dry-land taboleiros are not so heavily leached as in the Zone of the Mata, but water is even more difficult to find near the surface.

The Broad Plains with Erosion Remnants

In the Zone of the Caatingas the crystalline rocks—granites, gneisses, and quartzites, and even small areas with metamorphic limestones—have been worn down to two chief erosion levels. The higher one is preserved on the undissected upper surface of the Borborema; the lower one is developd as a broad plain studded

with sharp, rocky knobs or clusters of hills, presumably held up by rocks of superior resistance. The broad plains with erosion remnants is the largest of the subdivisions of the Zone of the Caatingas, occupying a vast area in Ceará in the drainage basin of the Jaguaribe, and again in Bahia and Pernambuco in the drainage area of the São Francisco. The broad plains of Ceará slope gently from the sea to about 500 meters (1800 feet) at the northern base of the Chapada de Araripe. South of the Araripe and the Borborema, the broad plains are about 350 to 400 meters above sea level (1100 to 1300 feet), but here the chief river, the São Francisco is intrenched, deeply so below the falls of Paulo Afonso as far as Marechal Floriano. The tributary streams descend toward the São Francisco through valleys shaped like wadis, with steep, sometimes cliffed sides, and flat bottoms, except that after rains in the headwaters the valleys are filled from side to side with torrential water. Above the broad sweep of the plains the horizon is dotted with sharp knobs and hill clusters. Around the base of each such elevation there is a gently sloping colluvial base. Here because of the availability of water, agriculture is concentrated. This feature in the Northeast is known as the *Pé da Serra,* the foot of the mountains.

The plains are dry, the soil coarse and porous. Under the hot sun the crystalline rocks are quickly mantled with broken rock fragments, and further splitting takes place whenever there is a sudden, cooling shower. Yet so coarse and porous is the loose material at the surface that even during a rain the water sinks rapidly into the thirsty ground, and wheeled vehicles can pass without difficulty over the wet earth. Except on the Pé da Serra, the ground water is so deep below the surface that it is difficult to reach by ordinary wells. Where earth dams have been built to catch water in the headwater swales which provide shallow indentations in the surface, water has not ponded behind them, so rapid is its descent into the ground.

Yet there are occasionally very heavy rains or cloudbursts of short duration and small extent. Such showers come occasionally to the whole area, but they come most frequently over the higher elevations, or on the eastern side of the cliffed Chapada de Araripe (Fig. 3). Water rushing away from these cloudbursts, especially around the Serra da Jacobina in Bahia, produces violent sheet floods. The surface of the broad plains between Uauá and Juazeiro is scored with shallow channels and mantled with debris of such floods (Fig. 5). If irrigation were to be attempted in the vicinity of Juazeiro, as it is being attempted in a small area along the Rio Salitre, some 40 kilometers (25 miles) west of that town, not only must water be provided for the crops but also protection from violent flood must be arranged. In other parts of the broad plains, where streams have formed sharply cut valleys, the flood waters are concentrated in these valleys which remain impassable until the water recedes. Most of the time, even in the rainy season, the valleys tributary to the São Francisco or the Jaguaribe and the Piranhas, are occupied only by strings of stagnant pools, or by shallow trickles of moving water.

The Massifs

Above the broad plains with their scattered erosion remnants stand two other

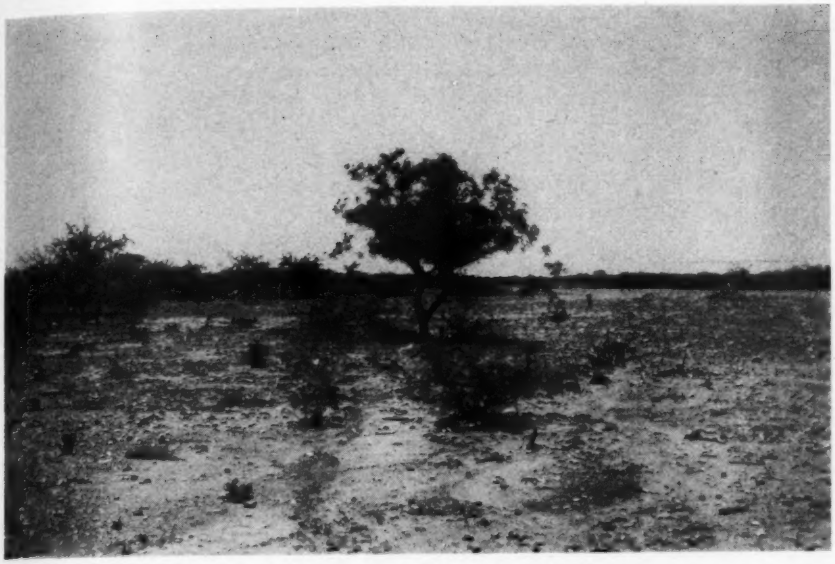

FIG. 5. Surface developed by sheet floods about 20 kilometers west of Juazeiro. The vegetation is a dry caatinga.

FIG. 6. The edge of the Borborema a short distance east of Patos, State of Paraíba.

kinds of remnants, extensive enough to be placed in separate categories. These are the remnants of the sandstone cap, and the crystalline massifs.

The massifs stand prominently above the surrounding country. The largest is the Massif of the Borborema (Fig. 6) which extends from the southwest corner of Paraíba along the border of that state with Pernambuco, eastward into the Zone of the Mata where its dissected eastern edge forms a large part of the hill lands previously described. The central part of the Borborema is a largely undissected, gently sloping surface standing some 800 to 1,000 meters (2,500 to over 3,000 feet) above the sea. Its margins are deeply dissected, and it faces the bordering plains of Pernambuco to the south, and of central Paraíba to the north, and of eastern Rio Grande do Norte to the northeast, with sharp mountain-like slopes.

In addition to the great Borborema, there are other groups of hills of sufficient size and elevation to be classified as massifs. There are small islands of this sort in Pernambuco and Alagoas near the São Francisco River. There are several deeply dissected massifs in Ceará in the vicinity of Baturité and Quixeramobim.

Some of these high massifs receive relatively abundant rains, even in dry years. To be sure, the part of the Borborema which faces Patos in central Paraíba and Jardim do Seridó in Rio Grande do Norte, and the undissected upper part of this massif between Barra and Campina Grande in Paraíba are very dry. Where the massifs present steep slopes to the moisture-bearing winds from the southeast and east, rainfall is heavy, amounting to well over 1,000 mm. (40 inches). These rainy spots were originally covered with mata (Fig. 7). These were the spots most sought by the Brazilian farmers. Over the centuries the forest has been cut, permitted to grow up again and recut several times, each time with severe soil erosion, and an aggravation of the condition of flood and drought along the drainage lines. Yet so rapid is the decomposition of the crystalline rocks that even on steep slopes bare rock is seldom to be found, but rather there is a deep porous, reddish soil, relatively fresh and little leached.

The Sandstone Cap

Other extensive remnants not yet entirely swept away by the processes of erosion are the pieces of the sandstone cap which once covered a large part of the region. The east-facing scarp along the border of Piauí and Ceará is the edge of this cap which covers a large part of the state of Piauí to the west of the area studied. East of this the largest piece of the cap is the Chapada de Araripe (Fig. 8) on the border of Ceará and Pernambuco. This great flat-topped sandstone tableland, some 600 meters (over 2,000 feet) above sea level, stands prominently above the bordering plains with steep, in places cliffed, sides. There are other smaller table-like remnants of the cap scattered to the east especially in Rio Grande do Norte.

These prominent tableland features, like the crystalline massifs, receive heavy rains even in dry years. The east-facing scarp of the Chapada de Araripe produces an up-draft in the moisture-bearing winds some distance to the east, so that in the area around Crato in Ceará more than 1,000 mm. (40 inches) of rain is received

FIG. 7. The Borborema a little east of Arcoverde, State of Pernambuco. This area was once covered with forest, but now only scrubby growth of trees covers its slopes and is being cleared again for crops.

FIG. 8. The Chapada de Araripe from the south. This is a remnant of the sandstone cap. Brush fence around bit of crop land in the foreground.

on the bordering plains as well as on the Chapada. The pieces of the sandstone cap were originally covered with tall forest, probably of *mata seca*. The soil derived from the sandstone cap rock is so porous that rain water quickly sinks into the ground, and since the surface is flat the removal of the trees has little effect on the rapidity of the percolation of water after a rain. Around the margins of the Araripe, and elsewhere in similar situations, the water emerges in springs from the base of the sandstone, thereby providing support for irrigation tracts which is not seriously disturbed by the removal of the forests above. On the flat top of the Chapada de Araripe water for the people who have settled there to raise crops is provided only by shallow tanks excavated in the surface to catch the rain.

The Sedimentary Basin of Bahia

Along the coast of Bahia north of Salvador and south of the border of Sergipe, the sedimentary strata of the taboleiros continue inland into the Zone of the Caatingas. This sedimentary basin overlies the crystallines, but its surface is at about the same elevation as that of the broad plains to the west and north. Standing above the generally level surface are crystalline knobs and hills which project through the sedimentary cover. Where valleys have been cut into the sedimentary strata, as between Canudos and Jeremoabo, or along the São Francisco between Jatinã and Petrolandia, the valley sides are of the cliff and platform character. On the edges of the sedimentary basin the strata are up-turned and have developed a series of out-facing cuestas. Notable among these features are the cuestas just south of Canudos in Bahia, and southwest of Arcoverde in Pernambuco. The sedimentary basin is marked by mesa-like hills in the part of Bahia south of the Rio Itapicurú and east of Feira de Sant'ana.

The Serra da Jacobina

In the southwest corner of the map (Fig. 3) the prominent range of low mountains known as the Serra do Espinhaço has its northern ending, where it is known locally as the Serra da Jacobina. This range forms an upstanding and unbreached divide between the streams tributary to the São Francisco and those which drain directly to the Atlantic all the way northward from central Minas Gerais—and in it are some of Brazil's most important minerals. The edge of the syncline of sedimentary strata west of Bonfim almost reaches 1,000 meters (nearly 3,300 feet) above the sea. Here also rainfall is abundant, and the higher slopes were originally forest-covered. The forests have long been removed.

The São Francisco Floodplain

The great river of the Northeast is the São Francisco.[22] But unlike other great rivers that bring water to an arid or semi-arid land, the São Francisco lies too deeply below the general level of the country through which it passes to make its waters easy to utilize (Fig. 9). Only upstream from Juazeiro is there a wide

[22] J. Zarur, *A Bacia do Médio São Francisco.* (Rio de Janeiro, 1946).

FIG. 9. Village on the lower São Francisco. The river does not rise high enough to reach it.

FIG. 10. The upper part of the Paulo Afonso Falls of the São Francisco.

flood plain. From Juazeiro to its mouth, the river is closely confined between high banks, and there are only narrow and detached bits of floodplain, most of these on the last 160 kilometers (100 miles) of its course. Throughout most of the dry part of the Northeast, where its waters would be useful for irrigation the lay of the land is such that irrigation would be costly and could be applied only to minute areas. The plan actually proposed to carry the waters northward between the Chapada de Araripe and the western end of the Borborema into the broad valley of the Jaguaribe and there to use it for irrigation would require expensive engineering works, and would meet considerable political difficulties due to conflicting needs for more water in Ceará and for continued flow for the power development at Paulo Afonso which will serve the more populous parts of the states south of the Borborema.

The Paulo Afonso Falls (Fig. 10) are located near the western corner of Alagoas where it borders Bahia. The crystalline rocks in this area are broken by two overlapping fault systems, one of which runs roughly from southwest to northeast, and the other from west northwest to east southeast. Along these lines of weakness the river has cut an angular course. The falls are produced where the water has excavated a deep trench running from southwest to northeast, at right angles to the course of the river, and into this trench the river descends in a series of tremendous cascades. The resemblance to the Victoria Falls of the Zambesi in Africa is striking. From the southwestern end of the trench, the river turns into a narrow canyon running from west northwest to east southeast. The railroad between Marechal Floriano and Petrolandia cannot be reached by steamers at either end. Ocean steamers can ascend only to Penedo; river steamers do not descend below Juazeiro. Marechal Floriano, however, is reached by small sailing boats that carry small cargoes from Penedo upstream.

The lower São Francisco does offer some fine silt floodplain soils, ideal for wetland rice. Most of these patches of superior land are below Penedo; the largest area is near the mouth of the river on the Sergipe (southern) side.

The Itapicurú Drainage Way

One of the remarkable features of northern Bahia is the Itapicurú drainage way. From the São Francisco around Juazeiro a covering of water-worn boulders crosses the broad plains and the sedimentary basin of Bahia southwestward to the valley of the Itapicurú (Fig. 11). This bouldery trail is more than 160 kilometers (100 miles) wide between Tucano and Jeremoabo. It is especially well developed around Uauá and Canudos. The surface of the land is mantled, in some places deeply, in other places only thinly, by an accumulation of polished water-worn pieces of quartzite. The longer axis of the quartz bounders is as much as 15 centimeters (6 inches). This coarse, bouldery gravel must have been deposited in the bed of a torrential river, presumably nothing smaller than the São Francisco itself, and presumably also during the period of rapid uplift which resulted in the development of extensive erosion levels in Southeastern Brazil.[23] This suggests that the elbow

[23] P. E. James, "The Surface Configuration of Southeastern Brazil," *Annals of the Association of American Geographers*, XXIII (1933): 165–193.

FIG. 11. The surface of the ground in the Itapicurú Drainage Way is covered with a mantle of water-worn quartz gravel.

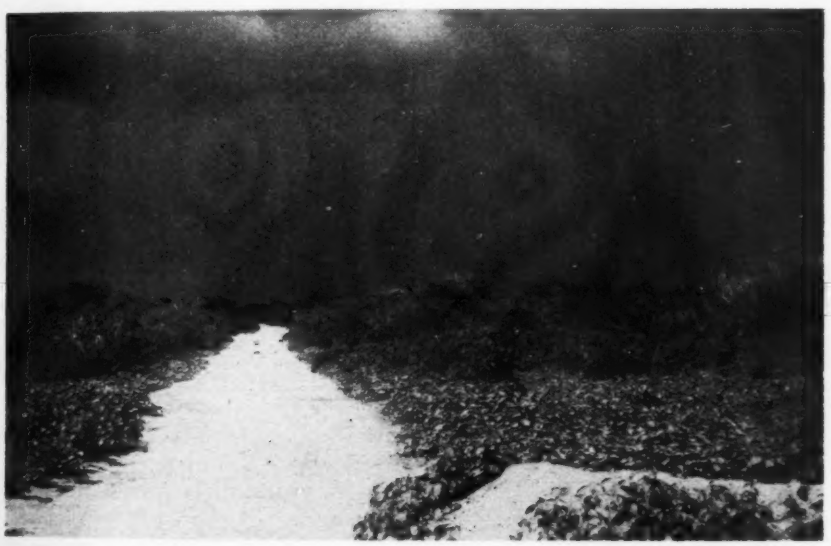

FIG. 12. Cloudburst ahead over the top of the Chapada de Araripe. A few moments later the water on the road was a foot deep. The original mata in this area has been cleared.

of capture is actually in the vicinity of Juazeiro and not near Cabrobó, as a hasty glance at the map might suggest. The latter bend may be related to the overlapping system of faults.

The drainage way with its very coarse, hard boulders offers the poorest land in the whole Zone of the Caatingas. Even for the grazing of goats, it is poor land, and spots suitable for agriculture are few, chiefly of the Pé da Serra type. It is no chance arrangement that locates such poverty spots as Uauá and Canudos in the midst of this dismal stretch of country, which is so vividly described by Euclides da Cunha in the classic *Os Sertões*. But da Cunha's descriptions apply to a much more narrowly restricted area than has commonly been supposed.

THE CLIMATE OF THE NORTHEAST

This land of complex surface features has an equally complex pattern of climatic features. The existing discussions of climate, however, are so broadly generalized that they provide a very inadequate picture of the actual conditions. This inadequacy is due in part to the lack of a common frame of reference for mapping climatic features, as explained above. It is also due to the fact that most of the climatic stations of the Zone of the Caatingas are located in the broad plains or on the coast, and only four are so placed that they reveal the heavier rains of the higher country. Thus a greatly over-simplified pattern of climatic features was developed, and then explained by greatly over-simplified meteorological processes. It is necessary, therefore, to reconsider the part played by the climatic factors in leading to the condition of poverty which it is our purpose to examine.

Unfortunately a proper study of the significant climatic conditions cannot be made because of the lack of recorded data. There are numerous rainfall stations in the Northeast—in fact a greater concentration of rainfall stations is to be found in this region than in any other part of Brazil. Rainfall has been recorded for many years by the *Inspetoria Federal de Obras contra as Secas*,[24] by the *Serviço de Meteorologia*, and by the *Divisão de Aguas*. In 1948 the data from various sources for the period 1914 to 1938 were published in the *Atlas Pluviométrico*.[25] But very few of the stations where rainfall was recorded also kept temperature records. To be sure, Freise offers a map on which the average annual temperature of 25° C (77° F) is shown in a highly generalized form,[26] and incidentally a form which would seem, on the southeast coast, to be incredible. This average annual isotherm passes just about through the middle of the region. But the small number of temperature stations make any revision of the isotherm impossible, and the attempt to apply Thornthwaite's system for the mapping of evapo-transpiration cannot be made. The Brazilians should be urged to establish a network of temperature and rainfall stations as soon as possible in order to make possible eventually the analysis of the most significant conditions of the climate.

[24] Now known as the *Departamento Nacional de Obras Contra as Secas*.
[25] *Op. cit.*
[26] F. Freise, "The Drought Region of Northeastern Brazil," *loc. cit.*; 368.

FIG. 13. Channel of one of the tributaries of the Rio Moxotó, western Alagoas. After a rain in the hills this channel is filled with a raging torrent. Typical caatinga.

FIG. 14. Road under construction between Uauá and Juazeiro, State of Bahia. Caatinga on the broad plains. New roads provide for the easier movement of people in and out of the Zone of the Caatingas.

Meanwhile, a careful examination of the rainfall stations reveals some serious difficulties. Of the 120 stations within the area under consideration not more than three or four are located high up in the wet parts of the massifs or on the sandstone caps. All the rest are either in deep valleys within the massifs, or on the broad plains, or along the coast. Within the Zone of the Caatingas, therefore, only four stations can be used to reveal the rainfall characteristics of those "islands" where field observation indicates the existence of mata (Fig. 12). These stations are Guaramiranga, in the hilly massif just west of Baturité in Ceará; Triunfo, on the top of the south-facing scarp which marks the edge of the Borborema in Pernambuco; Areia, high on the eastern edge of the Borborema in Paraíba; and Madre de Deus, in the Borborema northeast of Arcoverde in Pernambuco (the latter place not named on Fig. 4). All these stations are more than 600 meters (2,000 feet) above sea level, and Triunfo is over 1,000 meters (3,200 feet). All the other rainfall data for the Zone of the Caatingas come from stations in deep valleys, or from stations at elevations less than 600 meters (2,000 feet).

What do these four stations suggest concerning the rainfall of these higher places? They indicate a heavier average annual rainfall, all except Madre de Deus being over 1,000 mm. (40 in.); and they indicate a smaller average annual variation. The data for Triunfo, for example, show an average annual variation of rainfall of 24 per cent: at Patos, not far away to the northeast, where the average annual rainfall is as much as 924 mm. (36 in.), the average annual variation is 45 per cent. The variation of annual rainfall at these higher stations in the Zone of the Caatingas is comparable to the variation in the Zone of the Mata (Recife, 19 per cent; Natal, 21 per cent), and not at all like that of the broad plains of the Zone of the Caatingas (Quixeramobim in Ceará, 32 per cent; Cabrobó in Pernambuco, 40 per cent).

A New Rainfall Map

Supported by these data, and assisted by the map of surface configuration and by observations concerning the areas originally covered with forest, we have been able to prepare a new map of the average annual rainfall of the Northeast (Fig. 4). The rainfall stations and data are the same as those used for the preparation of the map in the *Atlas Pluviométrico*, but the isohyets have been drawn to take into consideration the evidence described above. Where islands of mata originally covered the higher elevations, even where no statistical evidence exists because of the lack of rainfall stations in these critical spots, the isohyets are drawn to indicate heavier rainfall. The most questionable of the areas of over 1,000 mm. (40 inches) in the Zone of the Caatingas is the island of heavier rainfall east of the Chapada de Araripe around Crato. No rainfall data are available for this area which, in spite of its position on the broad plains, seems originally to have been forest-covered. Is this mata area the result of rainfall produced along the front of the cliffed Chapada, or the result of moisture available from the numerous springs and the perennial streams they support at the base of the cliffs?

The rainfall map has also been revised in the Zone of the Mata between Salvador and Natal. Several earlier rainfall maps, including those contained in the *Atlas Pluviométrico*, show the cities of Aracajú, Maceió, Recife, and João Pessoa all to be located in spots of smaller annual rainfall along the coast, with stretches of heavier rainfall between them. Such a situation would be difficult to explain by the meteorological processes, and would offer an example of determinism which even the most ardent environmentalist might be inclined to scrutinize with care. There are no stations between these larger cities to indicate that heavier rainfall does in fact exist in the stretches of coast between them. Meanwhile, it is quite normal on a wet coast with winds on-shore to find the belt of maximum rainfall located a short distance inland. Without violating any of the statistical evidence as presented by the rainfall stations, such a rainy belt can be shown, leaving the whole coast in a zone of somewhat less rain.

THE PHYSICAL BACKGROUND OF POVERTY

We have offered certain observations concerning the arrangement of the physical and biological features of the Northeast. What do these observations mean in terms of the basic problem of poverty? To what extent is the condition of poverty to be linked with the recurrence of natural calamities?

It seems clear, in the first place, that the calamities are not entirely natural ones. More than four hundred years of destructive land use, during which the cover of natural vegetation has been repeatedly stripped away, has destroyed whatever capacity to retain moisture the soil may originally have possessed. The destruction of humus by burning, by exposure to hot sunshine, and by accelerated erosion resulting from exploitive farm practises has impoverished the resource base on which agricultural or pastoral settlement must rest. The concentration of agriculture on the steeper slopes has resulted in a quantity of soil erosion which is beyond measurement. Erosion has been severe enough to change the profiles of the hills, and the shape of the valley bottoms (Fig. 13). The regimen of the streams has been fundamentally affected; and the increased rapidity of run-off has resulted in a general lowering of the water table and in increased difficulty of retaining moisture near the surface. These are calamites, all right; but they are man-made.

The recurrence of flood and drought in the Northeast has apparently been most noticeable in its impact on the people of the region during the last century. Alternation of wet and dry years, on the other hand, is not limited to this period, but is even recorded in the Indian legends. But the years of drought were not described as years of calamity. The emigration of people from the Northeast began at the close of the first sugar period, when competition with the West Indies was ending the era of speculative profits from hill-side plantations. The great movement to southern Bahia and Minas Gerais where gold and diamonds were being mined was not pushed out of the Northeast by drought but rather was pulled out by the lure of greater economic reward. In the late 18th century another movement

led to new coffee plantations in Maranhão. Again, the outward movement was not a result of drought, for it took place during years of better than average rainfall. But from the middle of the last century on, there have been repeated migrations that were due to droughts. Migrations continue at the present time (Fig. 14), to the cacao forests of southern Bahia, and especially to the great cities of Rio de Janeiro and São Paulo where there is unheard of wealth to be had for the poor farmers or herders of the backlands. When there are droughts, the outward movement is especially strong.

The fact is that the resource base has been destroyed to such a degree that even the large landowners who are in a position to continue the destructive exploitation of soil and water, are almost as miserably poor as the tenants who occupy parts of their lands. The continued emigration of the most resourceful and imaginative elements of the population in each generation for over 200 years has produced an attitude of resignation in the face of environmental conditions. Today, no one can doubt the severity of the impact of flood or drought on an impoverished people.

We do not yet have a sufficient understanding of the relation of poverty to the conditions of the physical and biological environment. To suggest remedial measures without a more accurate picture of the present use of resources would seem dangerous. In a further report we propose to consider the economic geography of the Northeast—the sequence of settlement, the experience of people with the land, and the present-day relations of land use to the conditions we have discussed in this paper.

THE VERNON AREA, CALIFORNIA—A STUDY OF THE POLITICAL FACTOR IN URBAN GEOGRAPHY*

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URBAN agglomerations in the United States are characteristically spread over a complicated pattern of local political units. In the Los Angeles metropolitan area there are forty-five irregularly shaped municipalities of various sizes (Fig. 1). Among these incorporated municipalities lie numerous oddly shaped, discontinuous blocks of unincorporated county territory ranging in

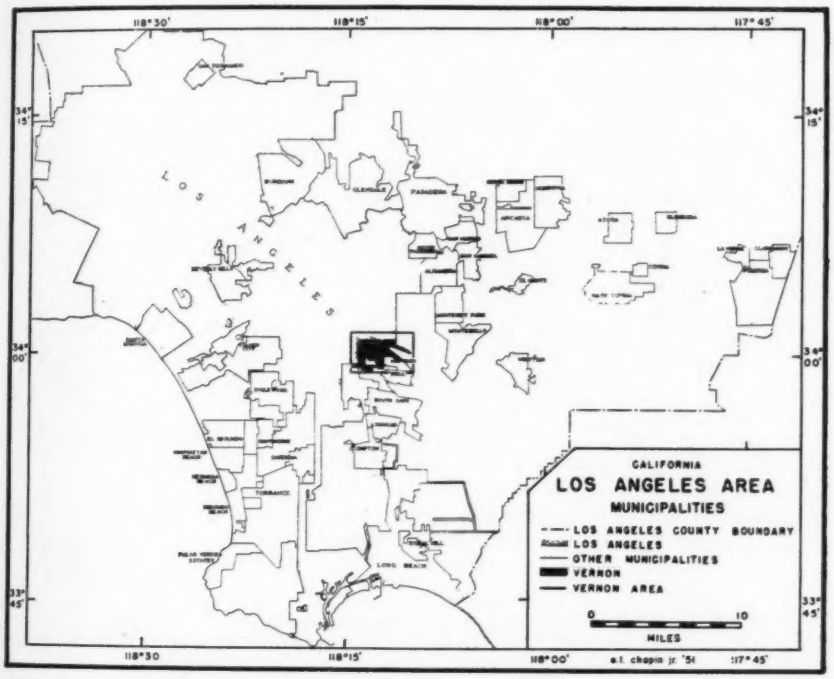

FIG. 1.

size from a few square yards to many square miles. Over the entire area man has built his features of urban occupance—dwelling units, commercial establishments, manufacturing plants, transportation arteries, public buildings, and the like.

There appears to be a present tendency among students of cities to minimize the importance of municipal and county boundaries and to consider the entire occupied

* This study was made possible by a Research Grant from the University of California.

area as a single "geographic" city. Recent census statistics, for instance, are reported for "Metropolitan Districts" and "Urban Areas," as well as for the "political" city. For many geographic purposes this trend represents a valid concept and a useful advance. However, one of the major concerns of urban geography is an understanding of the areal distribution and functional association of the numerous items in the urban landscape. Is it possible that the local political pattern is signifi-

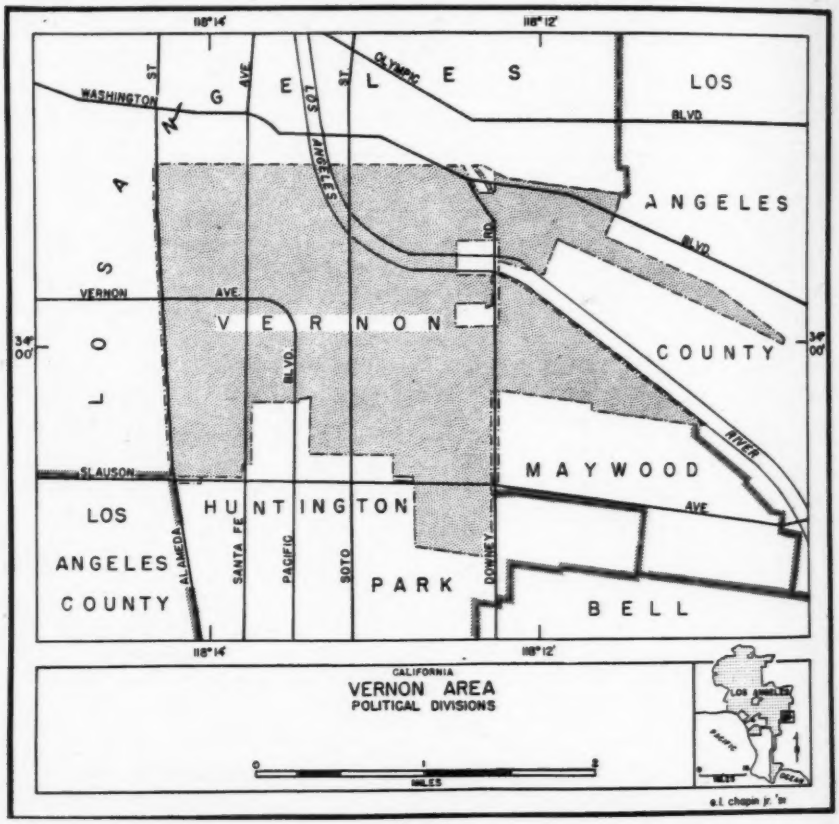

FIG. 2.

cant in this understanding? For example, are local municipal boundaries reflected in the urban land use pattern? Are there important variations in administrative elements from one political unit to another? If so, the local political complex within urban areas is an essential part of the geographic understanding of modern cities. The objective of this study is to attempt to find some preliminary answers to the above questions.

The number and complexity of such political relationships within the Los Angeles

metropolitan area preclude a detailed study and analysis of the entire sector in a single article. Therefore, a smaller area within the complex has been chosen for study. An area was selected where the elements of the physical environment were similar throughout; where Indian, Spanish, and early American settlement varied little; but where, at present, local political development is vigorous and distinctive.

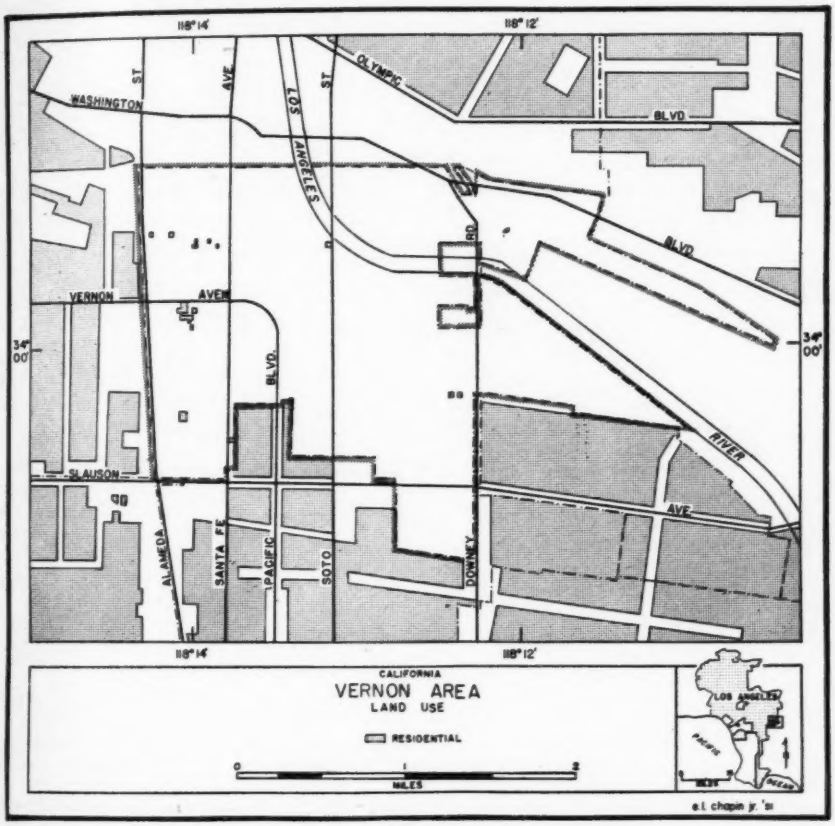

FIG. 3.

PRESENT COMPLEXITY

The city of Vernon and adjacent territory, located about two miles southwest of the Central Business District of Los Angeles, is the focal point of this paper. Vernon lies south of the southern boundary of the "four square Spanish leagues" of the old Pueblo that a hundred years ago formed the original city of Los Angeles.[1] As can be seen on Fig. 2, Los Angeles also borders Vernon on the west. Unincor-

[1] As slightly corrected by the Southern Extension of 1859.

porated county territory adjoins at the southwest corner and is also present along much of the eastern side of the city. The cities of Huntington Park and Maywood are adjacent on the south, with Bell a short distance away in this direction. This metropolitan mosaic, centered on the city of Vernon, limited about as indicated on Fig. 2, is the *Vernon Area.* In it are portions of five cities, and two blocks of unincorporated county territory. What is called the Vernon Area is not a functional unit. That name is simply a convenient term applied to the area selected for analysis in this study.

Residential Land

On a map showing residential land use (Fig. 3), the city of Vernon stands out as an almost empty island, surrounded by large blocks of land used for residential purposes. As is evident on Fig. 3, Vernon has no residential district. Its widely scattered houses occupy much less than one per cent of the developed area of the city as compared to the forty per cent usually devoted to this purpose (Table I).

TABLE I

Per Cent of Developed Area Occupied by Various Uses

	Average of 16 cities*	Vernon**
Residential	39.33	0.3
Commercial	2.38	0.6
Industrial	5.91	
Wholesale		19.2
Manufacturing		54.7
Railroad Property	5.50	13.4
Streets	33.61	11.1
Parks and Playgrounds	6.33	..
Public and Semi-public	7.61	0.7
	100.00	100.00

* Harland Bartholomew, *Urban Land Uses, Harvard City Planning Studies,* Vol. IV (Cambridge: Harvard University Press, 1932), Table 58, p. 138.

** Estimated, by means of overlay divided into segments of 1,000 square feet, from land use map of Vernon made in the field in Spring of 1951. Base from, City Engineer of Vernon, drawn 1950, scale 1 : 4.750.

The few houses in Vernon are generally old, unpainted, run-down structures, remnants of a bygone, pre-incorporation era. Three small clusters of newer residences exist. They are uniform and unpretentious stucco structures built on city property, near the police and fire departments, on water works property, and adjacent to the municipal power plant. These houses were World War II additions, suggested by the Army and Navy, and built to provide homes for a few key municipal workers near vital city facilities.

Population statistics bear out evidence provided by an observation of land use. The city of Vernon is insignificant in terms of resident population. In 1950 only

417 persons lived in Vernon, the smallest total in any city in Los Angeles County (Table II). Though situated in the midst of one of the fastest growing urban

TABLE II

	Population*				
	1950	1940	1930	1920	1910
Vernon	417	850	1,269	1,005	772
Huntington Park	29,375	28,648	24,591	4,513	1,299
Maywood	13,184	10,731	6,794	..	..
Los Angeles	1,954,036	1,504,277	1,238,048	576,673	319,193
Los Angeles County	4,116,901	2,785,643	2,208,492	936,455	504,171

* Source: United States Census, Census of Population.

areas in the United States, this city has been losing population at a rapid rate since 1930 and today has fewer persons than when it was incorporated (with less than half of today's area) in 1905.

Outside of Vernon, residential land is the dominant landscape feature in all of the municipalities and blocks of county territory adjacent to the city (Fig. 3). In almost every direction from Vernon important residential areas exist within a short distance from the Vernon city limits. Furthermore, the Vernon city boundary coincides almost exactly with the beginning of large blocks of residential land as one moves south out of Vernon into the cities of Huntington Park or Maywood. In contrast, the other local boundaries in the Vernon Area do not seem to coincide with breaks in the residential pattern. Then, too, in the areas outside Vernon, a wide variety of qualities and types of residential areas can be found.

The populations of both Maywood and Huntington Park have been growing steadily since their incorporation, and have now reached 13,000 and 30,000 respectively. Los Angeles city and county areas, similarly, have sizable and growing populations.

From the viewpoint of residential land, the Vernon city boundary appears significant. The boundaries of the other local municipalities do not appear to have had the same significance on residential development.

Commercial Land Use

Commercial areas, although generally well developed in the Vernon Area, are almost entirely absent in the city of Vernon itself. This is well illustrated by Fig. 4. The few commercial establishments existing in Vernon are widely scattered, and as a result Vernon has no real commercial core or shopping district. Grocery stores, drug stores, clothing establishments—all common retail features in the usual city—are not found in Vernon. There are only a few isolated restaurants and banks, and the ubiquitous filling station, serving the daytime needs of the persons employed by industries in the city. Only about one-fourth the usual percentage of

commercial land is found in Vernon (Table I). As a further indication of the unique morphology of the city, no retail establishments catering to pedestrian shoppers are found at what appears to be the point of easiest shopper accessibility—the corner of Santa Fe Avenue and Pacific Boulevard where two Pacific Electric transit routes intersect.

Other portions of the Vernon Area, as shown by Fig. 4, whether incorporated

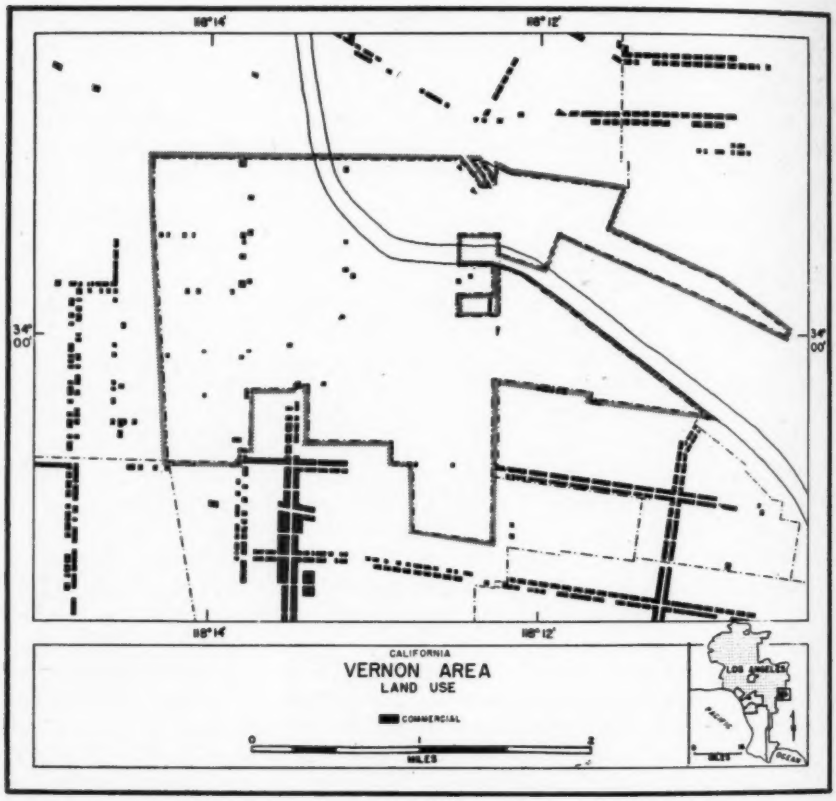

FIG. 4.

or unincorporated, possess apparently normal commercial development. There are well developed string-type commercial areas along streets carrying public transit lines, with modest nodal formations at several transfer points. Within these areas a wide variety of commercial enterprises flourish. On several occasions breaks in business development along a commercial street coincide with the Vernon city limit. Slauson Avenue, for example, is generally a commercial street within the

Vernon Area. However, except for three filling stations, it is completely barren of commerce in the two sectors, totaling about a mile in length, where it cuts across Vernon city territory.

Commercial land use appears to be significantly affected by the Vernon boundary. The political limits of other cities within the area, however, have little effect on

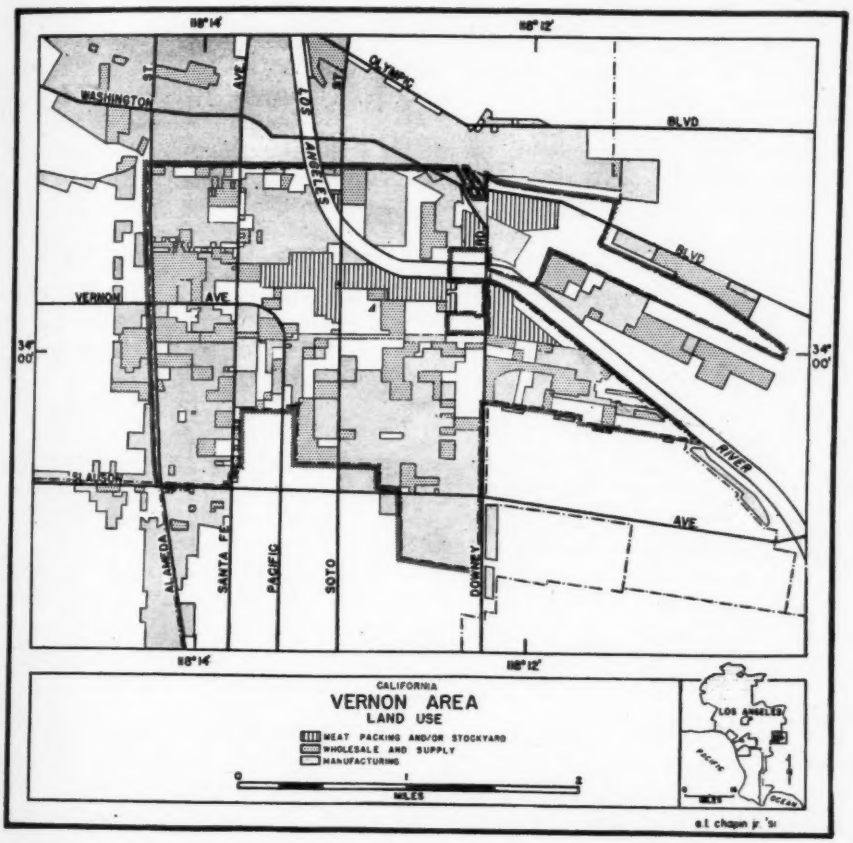

FIG. 5.

commercial development, for this type of land use extends across many of the borders with little interruption.

Industrial Land Use

The city of Vernon appears on Fig. 5 as a peninsula of industrial land almost surrounded by a sea of land used for non-industrial purposes. Nearly 75 per cent

of the developed land in the city is occupied by packing houses, oil processing plants, steel fabricating mills, breweries, fruit and vegetable packing houses, lumber yards, and other concerns covering almost the entire range of manufacturing and wholesaling. In an average city these account for perhaps six per cent of the occupied area (Table I). The packing houses and stockyards are concentrated between Vernon Avenue and the Los Angeles River, otherwise there is little specialization of areas within this industrial city.

Again, statistics reinforce the landscape impression. Though exact figures are unobtainable, the author estimates that about 60,000 persons are employed in the industries of the city. Ordinarily a city with a population of about 150,000 persons is required to produce this number of employees in *all* occupations. Many cities of half a million persons have only about this number of employees in manufacturing and wholesaling combined. Vernon's total is about 15 per cent of all persons employed in manufacturing in the city of Los Angeles, which has a population of about 2,000,000 persons. Moreover, in 1947, only 33 cities in the entire United States had a manufacturing labor force in excess of 60,000. A further idea of the magnitude of material processed and stored in Vernon is evident from the fact that only four cities in the state have a higher assessed valuation of personal property, and only seven California cities surpass Vernon's total assessed valuation of $128,563,445 (1948–49). This constitutes an assessed valuation of about 30 million dollars a square mile as compared to about 5 million per square mile for the city of Los Angeles.

Although there is some manufacturing and wholesaling in the surrounding areas as Fig. 5 illustrates, it is of a minor character, with the exception of the heavy manufacturing area in Los Angeles to the north. Statistically, Huntington Park has some 4,000 persons employed in manufacturing, Maywood less than 300.

In some instances, especially toward the south, areas solidly devoted to industry stop exactly at the southern border of Vernon. In other instances, some spilling over into adjoining blocks is noted. However, with the exception of the area to the north, mentioned above, a general coincidence with the boundary is evident.

Transportation

A dense network of railroad trackage (Fig. 6) ties the industrial structure of Vernon to the commercial world. Spur lines extend into almost every block in the city and connect with three major rail lines that cut through the city. Two major rail yards are also located in Vernon. The Santa Fe yards are located in a special extension of the city to the east, while the Los Angeles Junction yards occupy a portion of the southwest bank of the Los Angeles River. Vernon has over twice the average proportion of railroad property within its borders (Table I).

Again, the finely spaced network of rail trackage coincides generally with the city of Vernon. With the exception of the area just north of Vernon, no spur lines appear outside of the city in the entire area. The Southern Pacific Railroad running along Alameda Street sends some 14 spurs eastward into Vernon, none westward into the adjacent portion of Los Angeles.

Sixteen truck terminals (Fig. 6) account for much of the remaining occupied land within Vernon. Only four terminals are found in the remaining portion of the area under consideration.

The city's street pattern consists of a rather loose net tying together large blocks

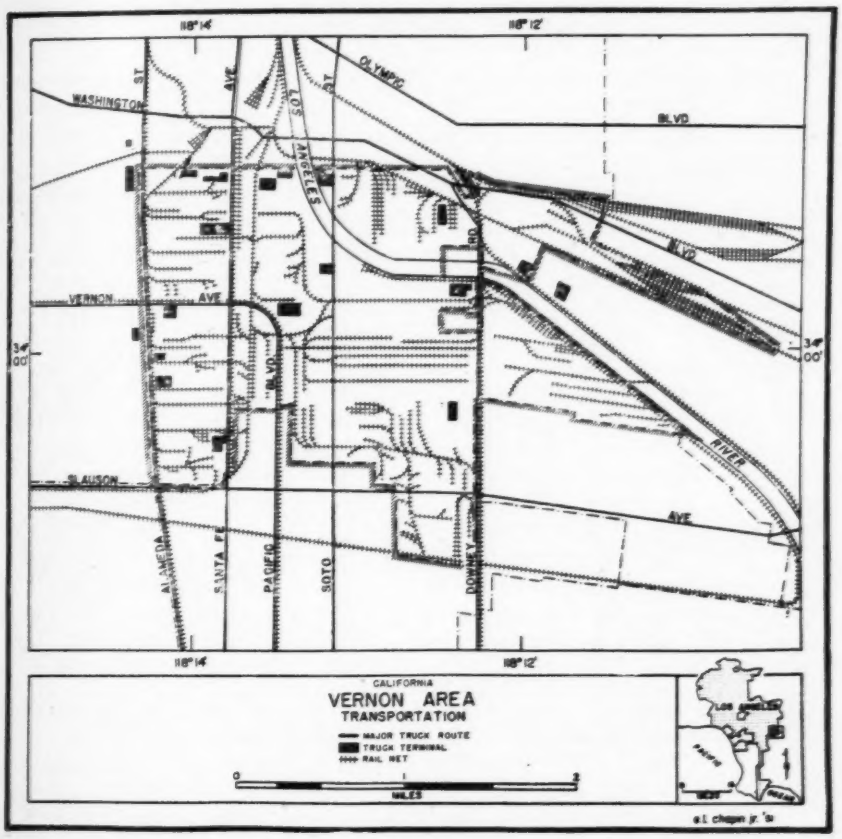

FIG. 6.

of generally non-residential land. Consequently, Vernon has only about one-third the usual area found in streets.

Thus, in transportation, as well as in residential, commercial, and industrial land use the Vernon city boundary seems to have real significance.

Public Land

There is little public land and there are few public buildings in Vernon (Fig. 7). A substantial city hall, a small school, and a weather-beaten Catholic Church are

present. But there are no parks, cemeteries, library buildings, or auditoriums. In the more populous neighboring areas, however, public buildings are found in the normal numbers.

ORIGINAL UNITY

In 1951, as has been demonstrated, Vernon exists as a distinctive urban structure, sharply differentiated from the structures of surrounding urban landscapes.

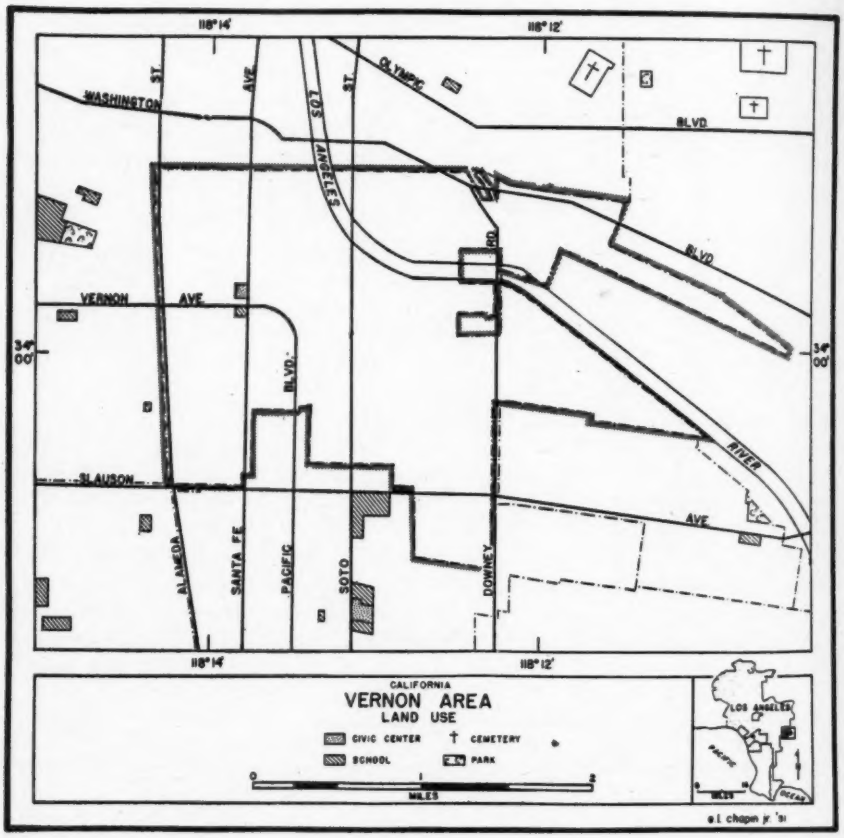

FIG. 7.

This, as will be seen, is a recent development, not characteristic of the many years of human occupance of the area. Until the beginnings of the twentieth century, the entire Vernon Area was seemingly homogeneous in physical qualities and undifferentiated by human use.

Physically the entire Vernon Area is a part of the Los Angeles Lowland that

lies between the San Gabriel–Santa Monica Mountains on the north and the Pacific Ocean on the south and west. Although this lowland is broken by numerous hill lands, the Vernon Area itself is a generally level plain cut diagonally in the northeast by the channelized bed of the Los Angeles River. No important earthquake faults cut through the subsurface of the Vernon Area. As the entire area is covered with unconsolidated gravels or clays, with sand predominating near the river, no significant differences in soils appear. The Vernon Area has a Mediterranean type of climate, and no important climatic variations occur in such a small area of uniform topography. No important variations are found in the natural vegetation cover. Water is generally available from similar underground sources over the entire area. In short, the Vernon Area is a region of physical homogeneity. Nothing exists in the physical landscape to which present land use variations can be related.

The first inhabitants, the pre-conquest Indians (the Gabrielino), did not disturb the original unity of the area. Although these people apparently roamed casually over the Vernon Area, no occupied site has yet been discovered within its boundaries.[2] These Indians, in a relatively primitive state of development, found little that was attractive here and chose other sites for their settlements where qualities were more suitable to their civilization.

Early Spanish explorers, seeing the area from the viewpoint of Eighteenth Century European culture, were unable to distinguish the uniqueness of Vernon. Sites for missions, and finally the Pueblo of Los Angeles, were located elsewhere. Significantly, but only accidentally, the four square leagues of the Spanish settlement bordered Vernon, but did not include it.

In 1810 the portion of the area not in the Pueblo and lying east of Santa Fe Avenue became part of Rancho San Antonio and was operated as such until subdivided about 60 years later. The area west of Santa Fe Avenue remained public land. Near the turn of the century both former rancho territory and former public land were being farmed by small ranchers working 5 to 20 acre plots.

By the beginning of the 20th century the stage was set for important events. The area was now within the dynamic organization of the United States. Transcontinental railroads were in operation linking the area with the populous east. Local rail lines, running from the core of Los Angeles to an improved harbor district to the south were built across the Vernon Area in three places.

The city of Los Angeles was growing in population and in area. The section of public land in the Vernon Area west of Alameda Street was annexed in 1893. However, the voters in the portion east of Alameda Street and west of the river rejected the proposed annexation in the same election, influenced "by men afraid of taxes."[3]

Several of the small ranchers living east of Alameda Street sensed the site qualities of the area for industrial development. Here was a level area of land,

[2] A. L. Kroeber, "Handbook of the Indians of California." *Bureau of American Ethnology, Bulletin 70.* (Washington: Smithsonian Institution, 1925), Plate 57.

[3] J. M. Guinn, *A History of California and an Extended History of Los Angeles and Environs.* (Los Angeles: Historical Record Company, 1915), Vol. I, p. 362.

crossed by three main railroads, and located just outside incorporated Los Angeles (a Los Angeles which reportedly had for its slogan "geraniums and tourists," and looked down its municipal nose at industry). The ranchers found the Southern Pacific Railroad interested in the possibility of picking up some local freight along its harbor line. Spur lines were built into the area south of 52nd Street between Alameda Street and Santa Fe Avenue and by the time the original city of Vernon was incorporated in 1905, two lumber yards and two manufacturing plants were already in operation.

TREND TOWARD DIVERSITY

With the legal incorporation of the city of Vernon the original unity of the Vernon Area gave way to diversity. Incorporation carries with it powers of license, taxation, and local regulation. Using these powers in a way somewhat different from neighboring cities, Vernon was soon able to attract a variety of endeavors of a type unknown in the surrounding territory. When the bars in Los Angeles closed at 10 P.M., Vernon's saloons operated until dawn. When Los Angeles limited drinks to light wines and beer, the self-styled "longest bar in the world" was built in Vernon. When prize fighting was illegal in many cities, Vernon was holding championship bouts in a coliseum seating 11,000 persons. When Sunday baseball was "blue-lawed" out of Los Angeles, the Vernon Tigers were playing on Sunday morning in their home park.

During Vernon's early career as a noisy sporting town, the surrounding districts were developing as quiet residential areas. Huntington Park, incorporated in 1906, developed into a generally balanced community. Homes were built into the area that at a later date was to become Maywood. Many complaints were voiced in the Los Angeles City Council regarding Vernon's lack of conformity. "Practically all the drunks arrested in Los Angeles get their booze in Vernon" and "Los Angeles taxpayers have to hire a police department to take care of Vernon's drunks" are typical statements.[4]

After World War I, Vernon lost its status as a sports and entertainment center. National Prohibition closed the saloons and the legalizing of boxing in many areas lost for Vernon its monopoly in this field. The Vernon Tigers were moved to a more convenient location in Los Angeles.

But loss of its sporting function did not mean that the area would return to its original homogeneity. Though sporting activities contributed much needed funds to the young city's treasury, the original purpose of the founders to develop an industrial city was kept constantly in mind. Factories, from the very beginning, developed as neighbors to the sports palaces. By 1914, less than ten years after the city's incorporation, the *Los Angeles Times* was referring to the "little industrial city of Vernon in the midst of a healthy period of growth."[5] Vernon's industries were stimulated by the First World War, but major industrial development did not

[4] *Los Angeles Times*, June 2, 1918.
[5] *Los Angeles Times*, June 14, 1914.

begin until the twenties. By 1925 there were some 300 plants in the city employing 15,000 people. Growth since that time has been steady and rapid.

Vernon has grown by migration of industry to its area, and also by annexing additional territory (Fig. 8). Several additions were of particular importance. In 1912 the main Santa Fe classification yards were brought within the city limits. However, the most important addition was the nearly 800-acre Central Manufactur-

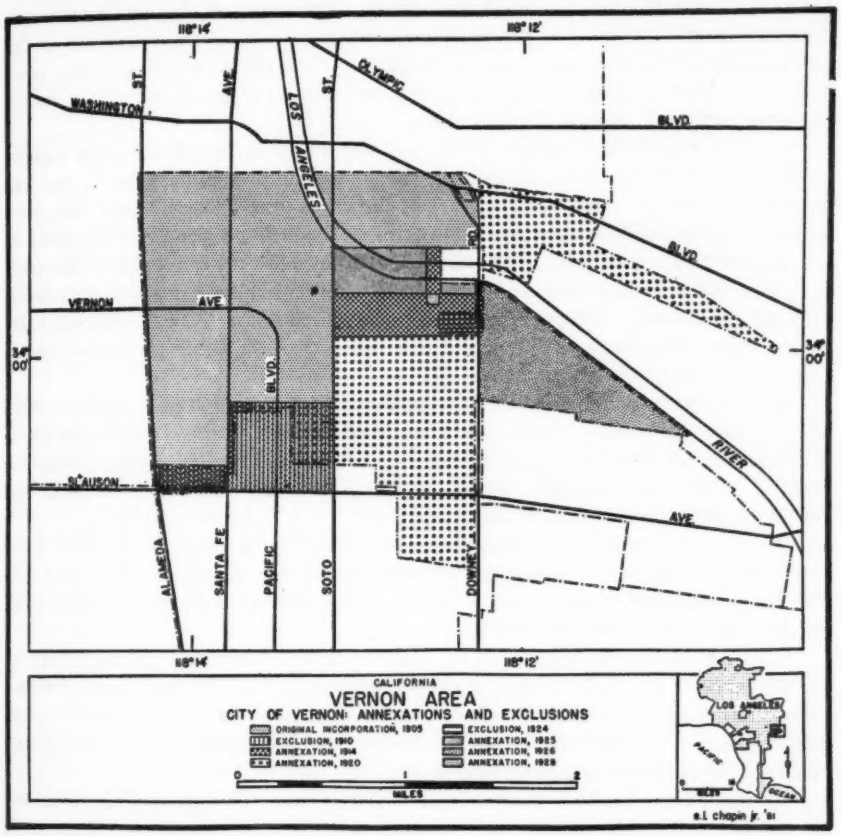

FIG. 8.

ing District annexed in 1925. This area, already built up with 28 industrial plants, added an assessed valuation of 8 million dollars to the city's resources.[6] Selective

[6] The *Los Angeles Times* of January 10, 1926 reports the event: "The annexation of the Central Manufacturing District, a triangular piece of land of about 300 acres was unanimously voted yesterday by Mr. and Mrs. A. J. Olsen, 4318 S. Downey Road, the only two legal voters in the district."

"The polls, located in the Olsen house, were kept open the legal number of hours, and the

annexations of this sort tended to bring more industries within the city, and to leave residences outside of the borders.

Vernon's population, however, did not keep pace with its expanding area. Although Vernon's population grew slowly during the first few years, there has been a rapid decline since 1930. Today, the city has fewer residents than when it was incorporated fifty years ago. This is not accidental. Annexations, generally, were planned to take in only non-residential areas. The policy of the city government has been hostile toward new residential construction and the rapid increase in the price of land made such structures unprofitable. The areas outside the city, however, have been gaining population rapidly as becomes units of one of the fastest growing metropolitan areas in the country (Table I).

All the while Vernon became more specialized and its boundaries more significant. The city government, though not always well informed, did what it could to encourage industry. In the early years of the city's development license fees were collected instead of taxes, and the industries and sporting places were expected to furnish their own police and fire protection. Taxes, once instituted, have been kept low, and today perhaps constitute one of Vernon's greatest industrial attractions. In 1949, for example, the Los Angeles city rate was $1.63 per $100.00 assessed valuation; Huntington Park, $0.92; and Vernon, less than $0.10, or the lowest rate of any city in the state of California.

Low tax rates are possible not only because of high valuation of industries within the city, but also because of the unique nature of the city. Lack of significant population makes possible omission of such public services as libraries, parks, community centers, clinics, and the like. Other facilities are poorly developed. Vernon has few street lights, sidewalks, or curbs, and a minimum of traffic signals.

Other public services of Vernon have been designed for a specialized city. They are economical to operate and make attractive features to industry. The police and fire department have become adept at the protection of industrial property with special equipment toward that end.

In water and power services, also, Vernon does not conform to the pattern of her neighbors. In 1933 a municipal power plant was built in Vernon in a successful attempt to bring down electric rates.[7] Vernon does not belong to the Metropolitan Water District, but has its own wells. It also has high pressure mains eliminating the need for expensive pumping equipment.

Vernon's city council is unique in several respects. Though having the power to regulate industries with a total value of several hundred million dollars, it is

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two voters were also the election officials. Vernon acquired 28 individual units, adding an assessed valuation of approximately $8,000,000. The principal loser will be the Maywood Grammar School, for years one of the richest in California."

[7] The plant, never put in actual operation, is now owned by Consolidated Edison Company, under a contract with Vernon which provides for payment of interest and retirement of the bond issue in full, plus payment of 22 per cent of the gross annual sale of power to the city of Vernon. J. B. Leonis, "The Vernon Story," *Vernon Industrial Supply News.* February 1951, p. 13.

responsible to only 139 registered voters.[8] The majority of these, it is charged, are employees of the city.[9] The personnel on the council has changed little since the founders and their friends were elected nearly 50 years ago. Public officials for many years owned large amounts of vacant land in the city. It has been commonly alleged that local ordinances were designed to speed its profitable occupance.[10]

The unusual government has had some advantages for industry, providing specialized regulations and services as previously noted. However, this arrangement has also been troublesome at times. For example, the Container Corporation of America in February 1950 was refused the right to expand alleging "Vernon's officials told the corporation they want to keep the balance of the city's sewer use capacity to permit industrial development of undeveloped Vernon property."[11]

CONCLUSIONS

The varied land use patterns in the Vernon Area cannot be correlated with topography, subsurface structure, climate, water supply, natural vegetation, or soils, for these physical elements are generally homogeneous throughout the area. Neither do pre-conquest Indian or Spanish settlement patterns offer clues to the present complex arrangements.

In the Vernon Area the distributions of residential, commercial, public, industrial, and transportational land are seemingly correlated with the Vernon city limits. Territory within the city of Vernon appears to repell the first three types of land use and strongly attracts the latter two. In numerous instances sharp breaks in land use coincide with the Vernon border. Conversely, the legal limits between other incorporated cities or blocks of county territory in the Vernon Area seem to have little effect on any of the major types of land use.

Administrative elements within Vernon that vary sharply from neighboring areas include such items as local tax rates, official attitude toward industry and residents, municipal services such as police and fire protection, water supply, and street maintenance.

Evidence presented in this study indicates that, because of the historic development of the city of Vernon, the municipal limits of this city are of prime importance in understanding urban land arrangements. However, the other local political boundaries, between the various city and county areas represented, have left no noticeable impression in the urban landscape.

[8] *Los Angeles Examiner*, April 1, 1951.

[9] *Consolidated Pacific Investment Co. vs. City of Vernon.* Superior Court Case No. 571,673, March 27, 1950, p. 6.

[10] *Ibid.*

[11] *Los Angeles Daily News*, February 11, 1950.

REVIEWS AND ABSTRACTS OF STUDIES

REGIONALISM

Merrill Jensen, ed.: *Regionalism in America.* xvi and 425 pp. Madison, Wisconsin: University of Wisconsin Press, 1951.

No geographer who is interested in the theory and practise of regional studies should fail to include this book in his library. It is a work of major importance although in places it is irritating to a geographer. The fifteen chapters are papers which were delivered at a symposium on regionalism held in April 1949 at the University of Wisconsin. The papers are grouped into five parts, and in front of each part is an introductory chapter in which the several papers of that part are reviewed. Of the twenty scholars who have collaborated to produce this work, not one is a geographer. Half of the authors are historians, three are sociologists, the others range from fine arts to the administrators of government and state agencies. There is a foreword by Felix Frankfurter.

The first of the five parts of this book deals with the history and application of the concept of regionalism as developed in America, written by Fulmer Mood, Vernon Carstensen, and Rupert B. Vance. The chapter on the historical development of ideas about regions from 1750 to 1900 contains much material of interest to persons concerned with the history of geographic thought. The contributions of Jedidiah Morse and others in the early 19th century, and their influence on historical writings of that period are discussed. The contrast between the statistical divisions proposed by Henry Gannett and the physiographic divisions of John W. Powell is described, and the influence of Powell on the thinking of Frederick Jackson Turner traced. The development of regional ideas since 1900 includes extended references to the works of W. L. G. Joerg, N. M. Fenneman, and to other regional discussions published in the *Annals* in 1928, 1934, and 1935. On page 124, in Vance's chapter, there is a statement which seems to call for clarification and fuller discussion. After pointing out that "the choice and delimitation of regions is a function of the research to be undertaken," the writer goes on to say: "Obviously, also, there are regions that will remain true regions regardless of whether any research is ever done or any administrative agencies ever set up with reference to their needs and functions." On the next page Vance says ". . . it is fortunate . . . that the physical, economic, and cultural contours of the region usually coincide." With these ideas the reviewer cannot agree. What is a "true" region, and are regions delimited for specific objectives to be described as "untrue" or false? Later on in the book, in another chapter, this assumption of coincidence along regional borders and the common failure to demonstrate coincidence of pattern are severely criticized. Vance is more at home with his analysis of the various statistical methods devised by sociologists for the definition of regions.

Part two presents actual analyses of three of the regions of the United States. A very old region, the South, is discussed by F. B. Simkins; a region which is old, yet at the same time only newly emerging as a region, the Spanish Southwest, is treated by J. W. Caughey; and a very new region, the Pacific Northwest, is analyzed by Lancaster Pollard.

Part three consists of four chapters dealing with the regional aspects of American culture. Here regionalism in literature, painting, architecture, and language—the latter by Hans Kurath—are presented.

Regionalism as a practical force constitutes part four, with chapters on the Tennessee Valley Authority, the Great Lakes Cutover region, and the Great Plains-Missouri Valley region. A geographer may be slightly irritated by the chapter by W. A. Rowlands on the cut-over region which is based almost exclusively on the experience with land inventory and rural zoning in Wisconsin. Even in the bibliography there is no mention of the Michigan Land Economic Survey, although the existence of the cut-over problem in Michigan is mentioned. Schoenmann's paper on rural planning in Alger County, Michigan, was published in 1932: the initial attempt to undertake the inventory as a background for rural zoning in a Wisconsin county was made in the same year. The fact that geographers played a larger role in the Michigan survey than they did in the Wisconsin survey is not mentioned.

The last part of the symposium consists of two papers, one by Louis Wirth, one by Howard W. Odum, with an introduction by Merle Curti, which together offer a summary and evaluation of the whole undertaking. Wirth's chapter on the limitations of regionalism and Odum's chapter on the promise of

regionalism are supposed to present two opposite points of view. Actually both agree on the value of regionalism as a useful tool in social science research and in public administration, but Wirth is more skeptical of the ultimate value of this approach, more ready to warn of the possible falsification of facts which are forced into a regional mold. Wirth says "if we do not mean by the term 'region' to call attention to the fact that we are looking at life in terms of the space dimension and the interest in location and position which that implies, then the term 'region' has no intelligible meaning whatsoever." He describes four different kinds of regions: 1) natural or cultural areas defined in terms of homogeneity; 2) areas set off by barriers whether natural or man-made; 3) areas which are integrated around a focal point—which Whittlesey calls nodal regions; 4) areas defined in terms of an *ad hoc* problem. "Short of considering the whole world as a single region," writes Wirth, "which, of course would be self-defeating, there is no other regional arrangement, of lesser scope, which will fully satisfy the many interests that clamor for recognition." Regions offer a useful tool, the value of which depends on a clear understanding of the limitations of the method. This would seem to accord quite fully with the ideas of the geographers who have worked with regions, but it does not go quite far enough to recognize the region as a geographical generalization and to make clear the need for a scale of degrees of generalization.

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MAN AND ENVIRONMENT IN THE TROPICS

M. Bates, *Where Winter Never Comes.* 310 pp. New York: Scribner's, 1952.

In the latter half of the 19th Century naturalists made significant contributions towards an understanding of the nature of the tropics. It is therefore of interest to review a book by a contemporary naturalist who has inspected that part of the world made famous by his predecessors. Mr. Bates, fortified by years of experience in southern Florida, Guatemala, Honduras, and Colombia, expresses a definite prejudice in favor of low latitude living.

The objectives of the book are outlined early in the text. The author wishes to write about "man and environment in the tropics," stressing the general concepts of history and geography. He is an avowed opponent of Huntington's climate and civilization thesis. By inference, he suggests that he, as a "scientist," will attempt to examine the tropics from the scientific point of view. The finished product is written in a casual style designed largely for a non-scientific audience.

A wide variety of loosely associated subjects are investigated by Mr. Bates. Included are such topics as the historical development of Western contact with the tropics, the varieties of tropical man and culture, tropical climates, diseases, food, forests, seas, resources, governments, and the areal relationship of the low latitudes to the rest of the world. Each offers an opportunity for the expression of personal opinion which the author does not hesitate to exploit. The result is a highly readable book —but one which is painfully inaccurate from the standpoint of fundamental geography, history, anthropology, and political science.

Mr. Bates appears to be confused about the definition of the term "tropics." This is reflected in his basic incompetence to analyze world climatic patterns. For example, geographers will be interested to learn that the polar ice caps exert a controlling influence on mid-latitude regions by the agency of polar fronts, that monsoon climates are subhumid, and that tropical deserts can be explained without reference to ocean currents. His maps on climate and the rain forest are grossly misleading. Mr. Bates recognizes that climates cannot be catalogued by the Aristotelian system but he defines his tropics in terms of the classic latitudinal limits. Within these limits he examines only the selva in detail. It is apparent that his love for the tropics is, in truth, an admiration for a specific land type within it, namely the selva. Thus by omission he is guilty of perpetuating the popular concept that the tropics are made up largely of rain forests.

Geography is not the only field carelessly interpreted. His assumption that the "Aztec empire that Cortes found in the highlands of Mexico was, of course, an offshoot of (the) Mayan civilization . . ." is an unsupported hypothesis. Mr. Bates has confused Vavilov's centers of plant domestication by dogmatically attributing maize, beans, squashes, peppers, cotton, and sweet potatoes to the Andean peoples. He has failed to recognize the growing iron

ore industries in Venezuela and the political tensions characteristic of much of Latin America. In short, his enthusiastic efforts to ascribe significance to the tropics on a comprehensive scale have led to generalizations which reveal the shallowness of his research.

Certain aspects of the book deserve a favorable comment. His ecological approach to climate is comparatively foreign to geographers. This system recognizes that the climate of a region ("geoclimate") differs from that of a small field-size area ("ecoclimate"), which in turn is different from the climate which surrounds an individual organism ("microclimate"). Mr. Bates also draws an analogy between the tropical rain forest and tropical seas, calling attention to the fact that it is necessary to inspect both from a zonal perspective. Thus, in the humid tropics, he would differentiate the climates of the tree crest zone from those of the forest floor zone, and would inspect tropical seas from the standpoint of life layers as well as areal distribution. An understanding of zonal differences is important in examining the "niches" in which life lives, particularly where human economies and human health are concerned.

Mr. Bates is convinced that the Western world is not culturally oriented to understand and develop the resources of the tropics. He is suspicious of the Point Four program and air conditioning, remarking that they are unsatisfactory attempts to model tropical living after a pattern prescribed by Western cultures. Some reorientation of attitude and technology will be necessary if a development program is to succeed. The resources of the tropics, imperfectly appreciated, "should be calculated in terms of sunshine and warmth and (in the equatorial region, at least) rainfall: which combine to produce the most favorable conditions possible for vegetation." He recommends that scientific institutions be established in the tropics to investigate the utilization of this unrealized resource.

Where Winter Never Comes seldom rises to meet its objectives. As a demonstration of the scientific method it is a dismal failure. In his enthusiasm to demonstrate the importance of the tropics the author has made a variety of assumptions which are contrary to the fundamental concepts of many disciplines. His personal experiences in the selva have led him to exploit this landscape type to the almost complete exclusion of the semideciduous forests, savannas, steppes, and deserts. Mr. Bates has been of service in moralizing about the shortcomings of Western culture which have become the "white man's burden" in the low latitudes, and his one-sided chapter on "tropical nature" is excellent within its limited bounds. As a naturalist, however, he has made fewer contributions than one would have a right to expect in a discussion of the tropics.

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